US006009469A

United States Patent [19]

Mattaway et al.

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[45] **Date of Patent: Dec. 28, 1999**

[54] **GRAPHIC USER INTERFACE FOR INTERNET TELEPHONY APPLICATION**

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[73] Assignee: **NetSpeak Corporation**, Boca Raton, Fla.

[21] Appl. No.: **08/721,316**

[22] Filed: **Sep. 25, 1996**

Related U.S. Application Data

[63] Continuation-in-part of application No. 08/533,115, Sep. 25, 1995

[60] Provisional application No. 60/025,415, Sep. 4, 1996, and provisional application No. 60/024,251, Aug. 21, 1996.

[51] **Int. Cl.**[6] **G06F 17/00**

[52] **U.S. Cl.** **709/227**

[58] **Field of Search** 395/200.57, 200.58; 709/227, 228; 370/352, 355, 357, 389, 395

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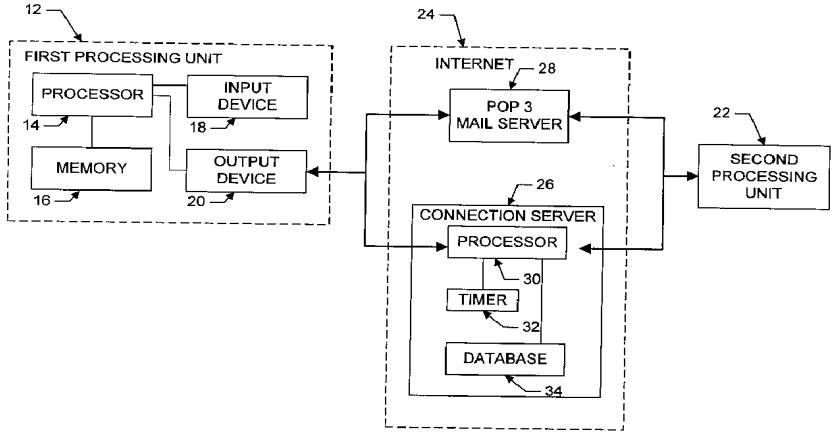
Primary Examiner—Ellis B. Ramirez

Attorney, Agent, or Firm—Kudirka & Jobse, LLP

[57] **ABSTRACT**

A communication utility for establishing real-time, point-to-point communications between processes over a computer network includes apparatus for querying a server as to the network protocol address of another client process, and apparatus for directly establishing a communication link with the client process upon receipt of the network protocol address from the server. In one embodiment, the utility includes a sophisticated user interface having features similar to typical telephony hardware but implementing greater flexibility with software.

18 Claims, 27 Drawing Sheets



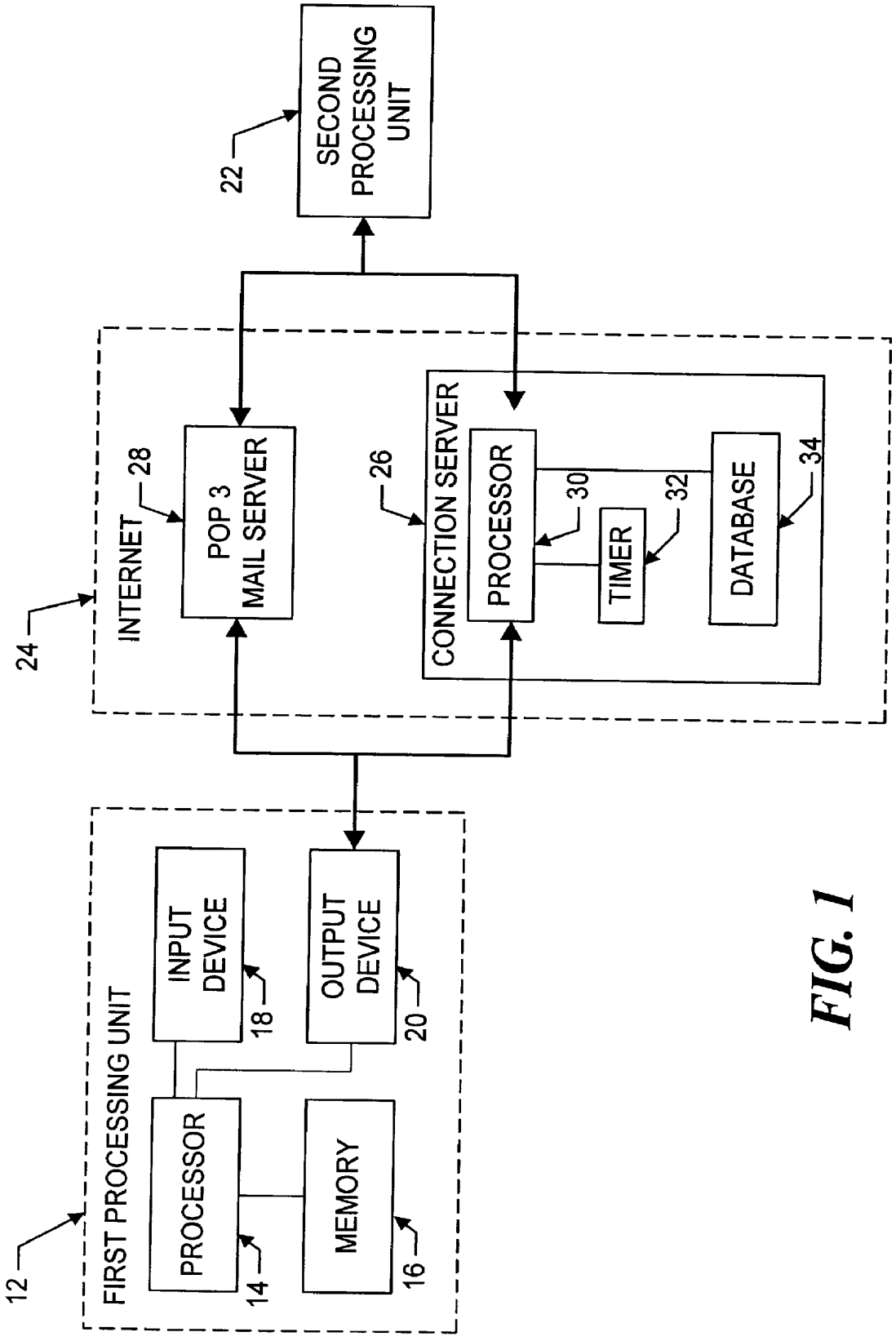

SECOND PROCESSING UNIT
22
INTERNET
24
POP 3 MAIL SERVER
28
CONNECTION SERVER
26
PROCESSOR
30
TIMER
32
DATABASE
34
FIRST PROCESSING UNIT
12
INPUT DEVICE
18
OUTPUT DEVICE
20
PROCESSOR
14
MEMORY
16

FIG. 1

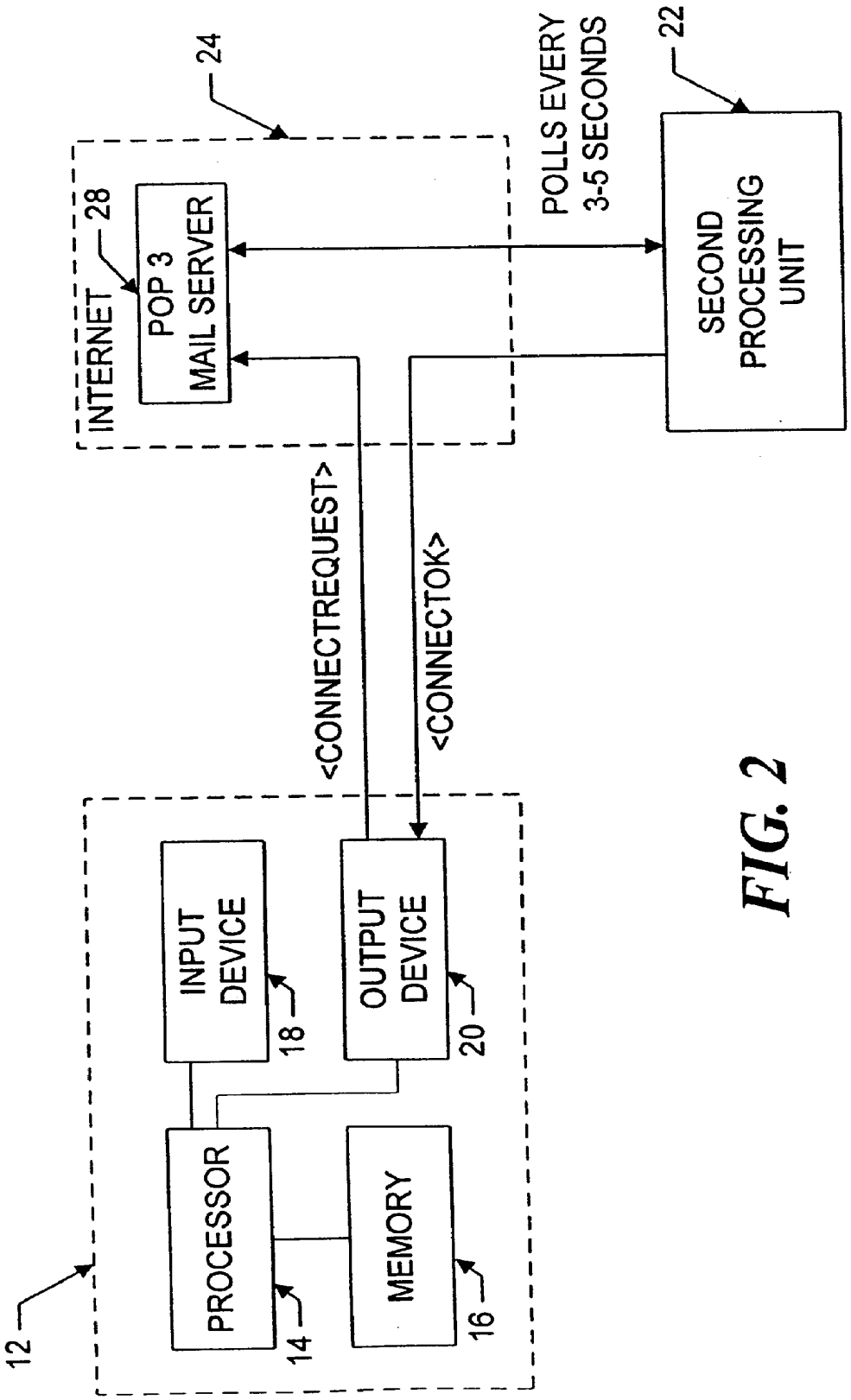

24
22
POLLS EVERY
3-5 SECONDS
INTERNET
28
POP 3
MAIL SERVER
SECOND
PROCESSING
UNIT
<CONNECTREQUEST>
<CONNECTOK>
INPUT
DEVICE
18
OUTPUT
DEVICE
20
PROCESSOR
14
MEMORY
16
12

FIG. 2

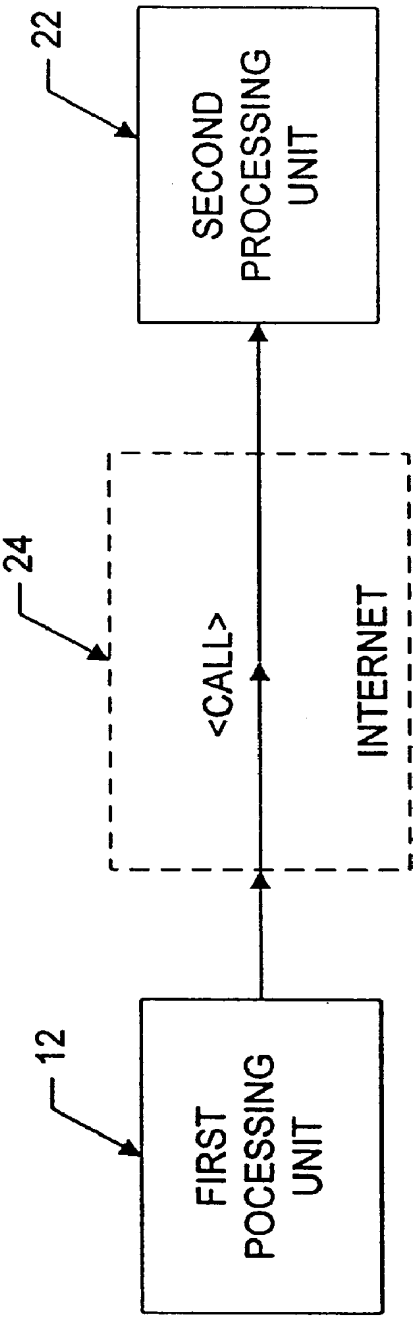

22
SECOND PROCESSING UNIT
24
<CALL>
INTERNET
12
FIRST POCESSING UNIT

FIG. 3

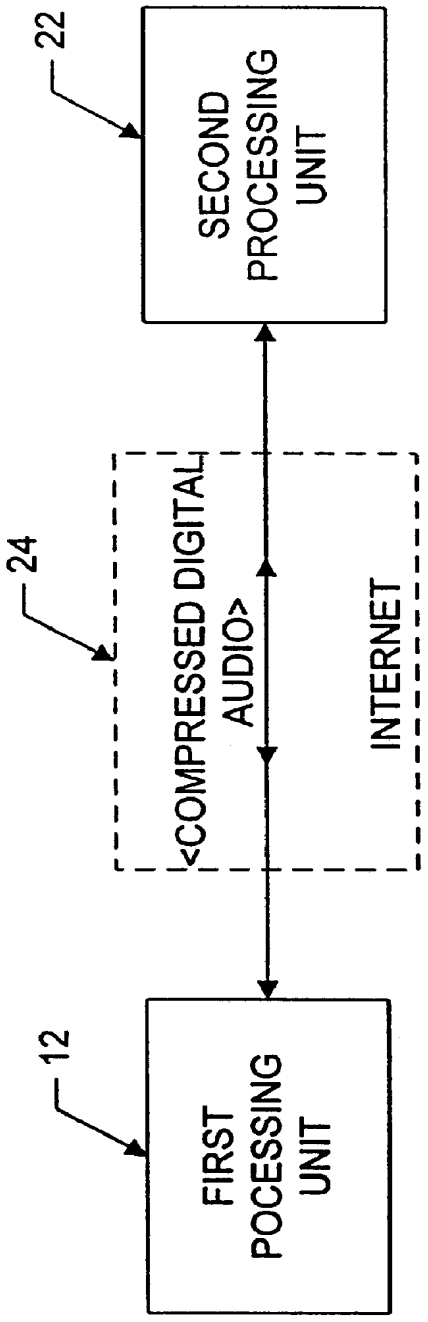

22
SECOND PROCESSING UNIT
24
<COMPRESSED DIGITAL AUDIO>
INTERNET
12
FIRST POCESSING UNIT

FIG. 4

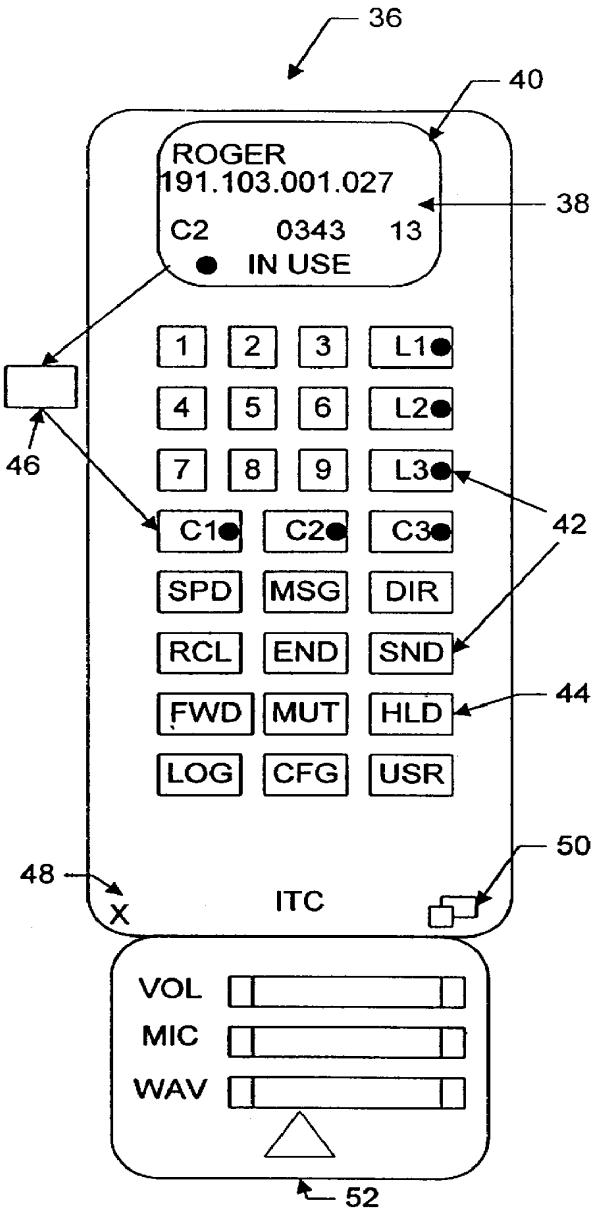

36
40
ROGER
191.103.001.027
C2 0343 13
IN USE
38
1 2 3 L1
4 5 6 L2
7 8 9 L3
C1 C2 C3
SPD MSG DIR
RCL END SND
FWD MUT HLD
LOG CFG USR
42
44
46
48
X
ITC
50
VOL
MIC
WAV
52

FIG. 5

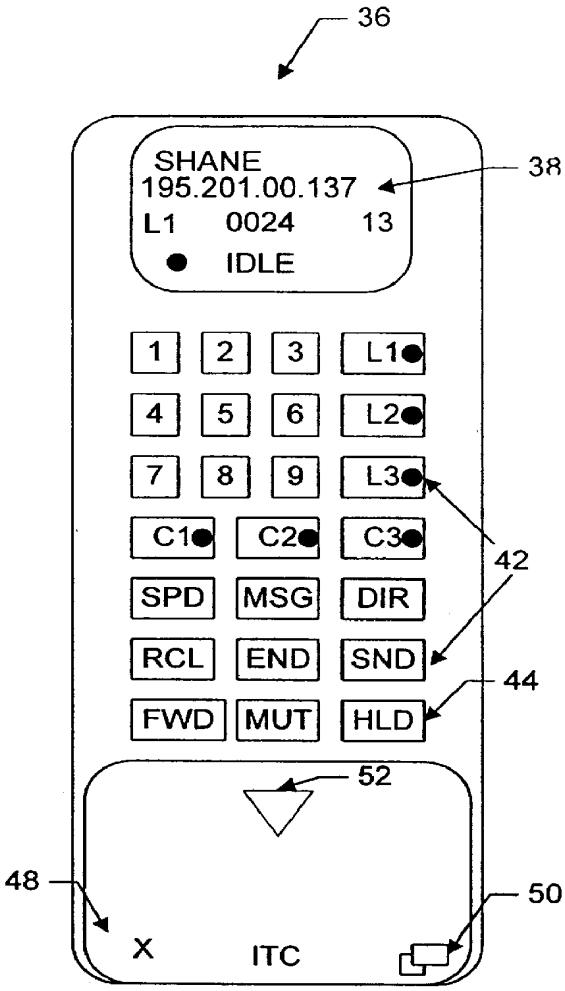

36
SHANE
195.201.00.137
L1 0024 13
IDLE
38
1 2 3 L1
4 5 6 L2
7 8 9 L3
C1 C2 C3
SPD MSG DIR
RCL END SND
FWD MUT HLD
42
44
52
48
X
ITC
50

FIG. 6

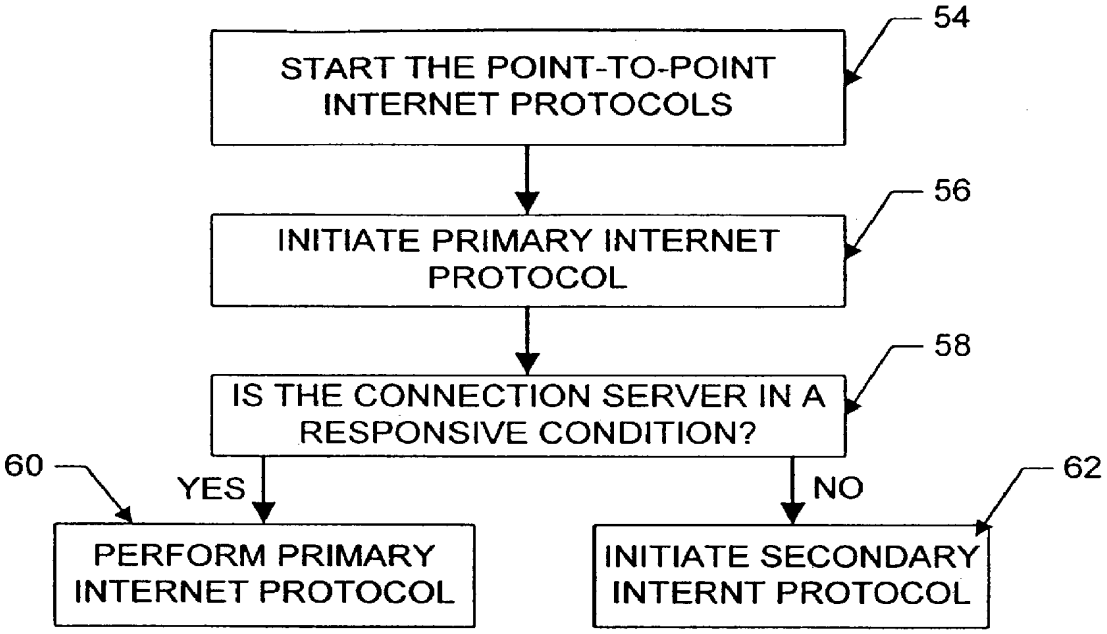

54
START THE POINT-TO-POINT INTERNET PROTOCOLS
56
INITIATE PRIMARY INTERNET PROTOCOL
58
IS THE CONNECTION SERVER IN A RESPONSIVE CONDITION?
60
YES
NO
62
PERFORM PRIMARY INTERNET PROTOCOL
INITIATE SECONDARY INTERNT PROTOCOL

FIG. 7

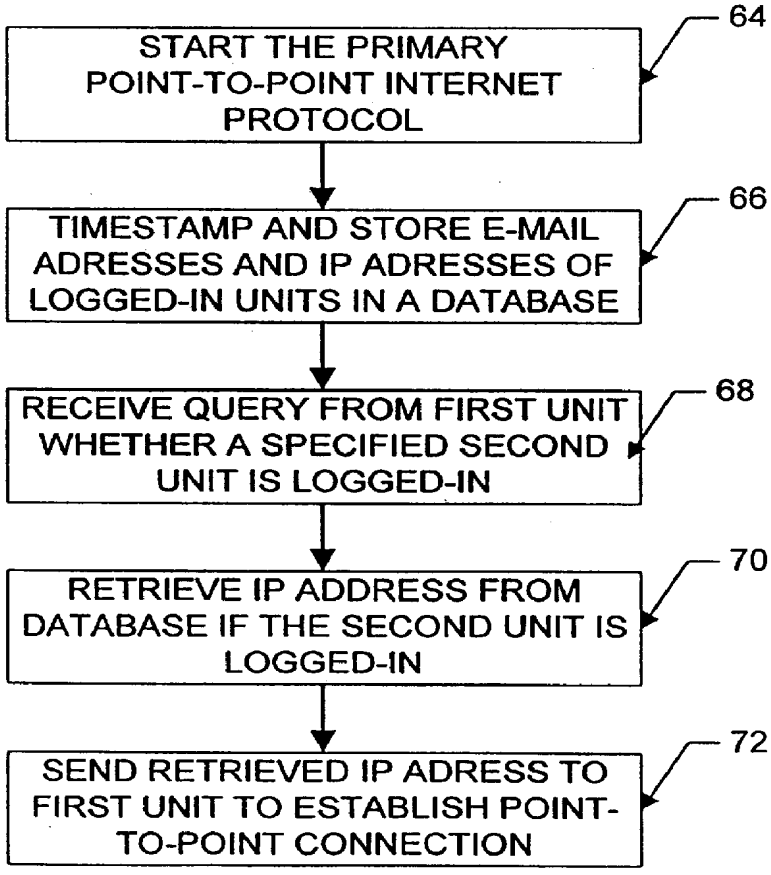

64
START THE PRIMARY POINT-TO-POINT INTERNET PROTOCOL
66
TIMESTAMP AND STORE E-MAIL ADRESSES AND IP ADRESSES OF LOGGED-IN UNITS IN A DATABASE
68
RECEIVE QUERY FROM FIRST UNIT WHETHER A SPECIFIED SECOND UNIT IS LOGGED-IN
70
RETRIEVE IP ADDRESS FROM DATABASE IF THE SECOND UNIT IS LOGGED-IN
72
SEND RETRIEVED IP ADRESS TO FIRST UNIT TO ESTABLISH POINT-TO-POINT CONNECTION

FIG. 8

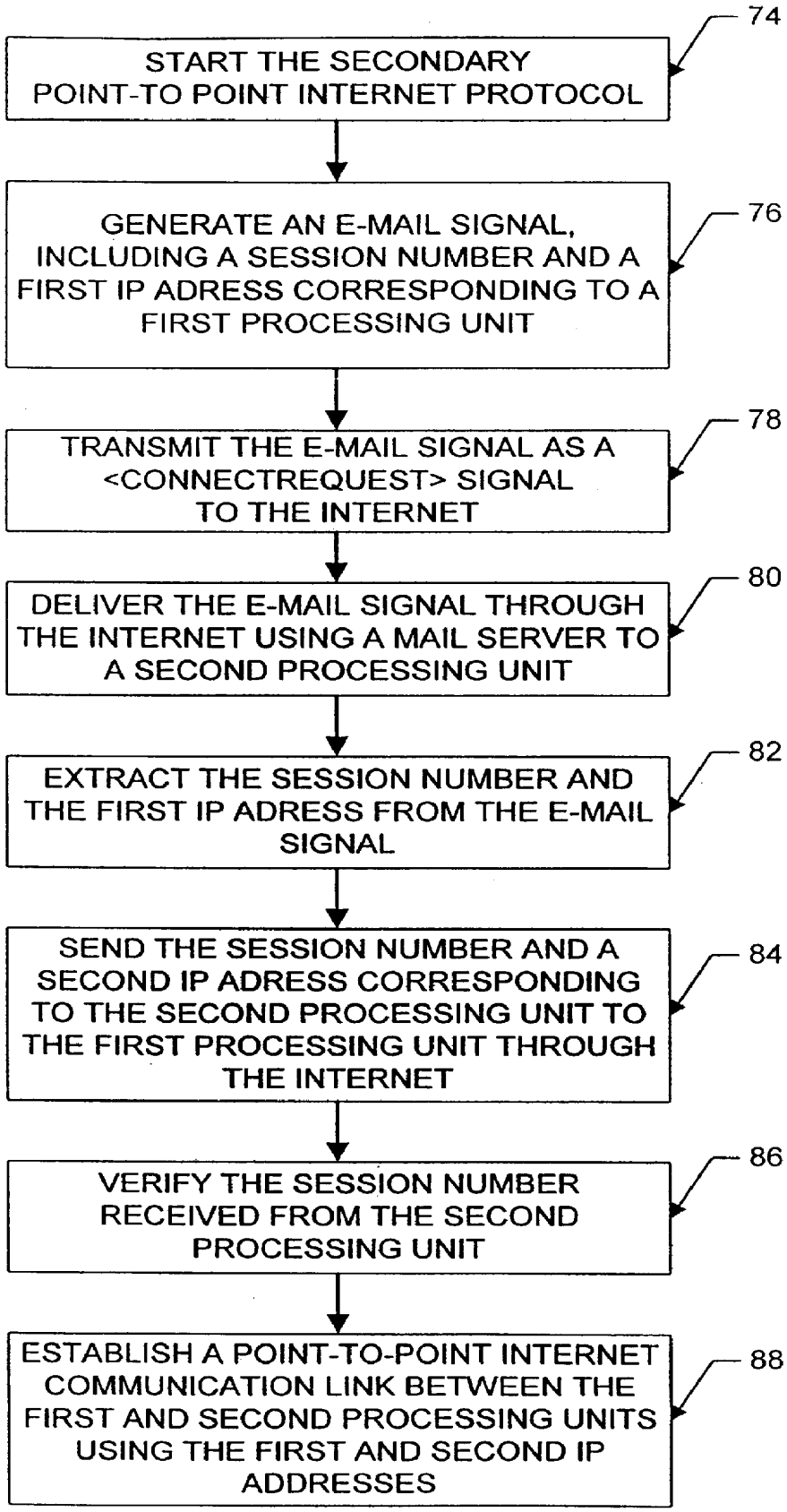

START THE SECONDARY POINT-TO POINT INTERNET PROTOCOL
74
GENERATE AN E-MAIL SIGNAL, INCLUDING A SESSION NUMBER AND A FIRST IP ADRESS CORRESPONDING TO A FIRST PROCESSING UNIT
76
TRANSMIT THE E-MAIL SIGNAL AS A <CONNECTREQUEST> SIGNAL TO THE INTERNET
78
DELIVER THE E-MAIL SIGNAL THROUGH THE INTERNET USING A MAIL SERVER TO A SECOND PROCESSING UNIT
80
EXTRACT THE SESSION NUMBER AND THE FIRST IP ADRESS FROM THE E-MAIL SIGNAL
82
SEND THE SESSION NUMBER AND A SECOND IP ADRESS CORRESPONDING TO THE SECOND PROCESSING UNIT TO THE FIRST PROCESSING UNIT THROUGH THE INTERNET
84
VERIFY THE SESSION NUMBER RECEIVED FROM THE SECOND PROCESSING UNIT
86
ESTABLISH A POINT-TO-POINT INTERNET COMMUNICATION LINK BETWEEN THE FIRST AND SECOND PROCESSING UNITS USING THE FIRST AND SECOND IP ADDRESSES
88

FIG. 9

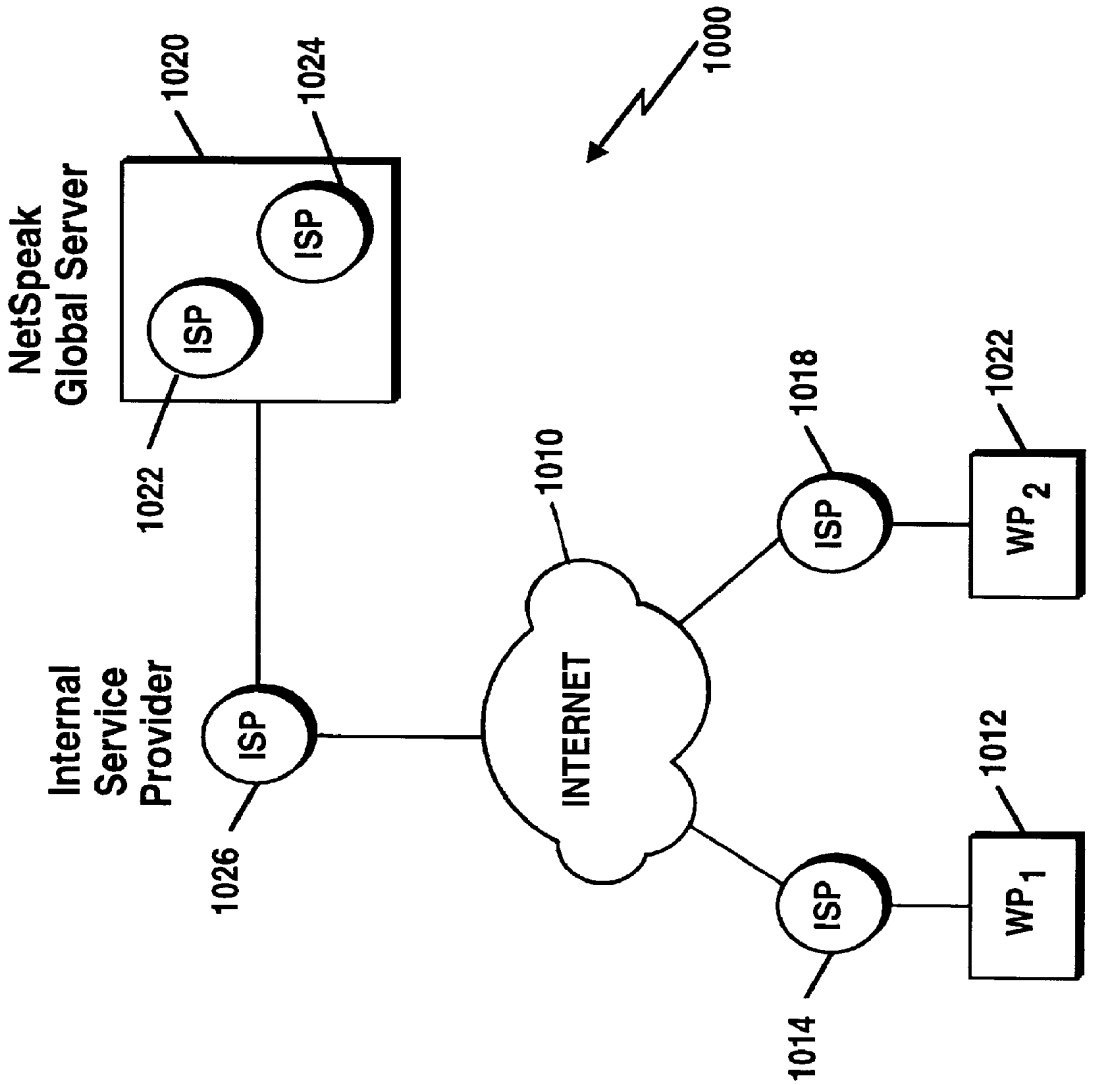

1000
NetSpeak Global Server
1020
1024
ISP
ISP
1022
Internal Service Provider
ISP
1026
INTERNET
1010
ISP
1018
ISP
1014
WP 2
1022
WP 1
1012

Figure 10

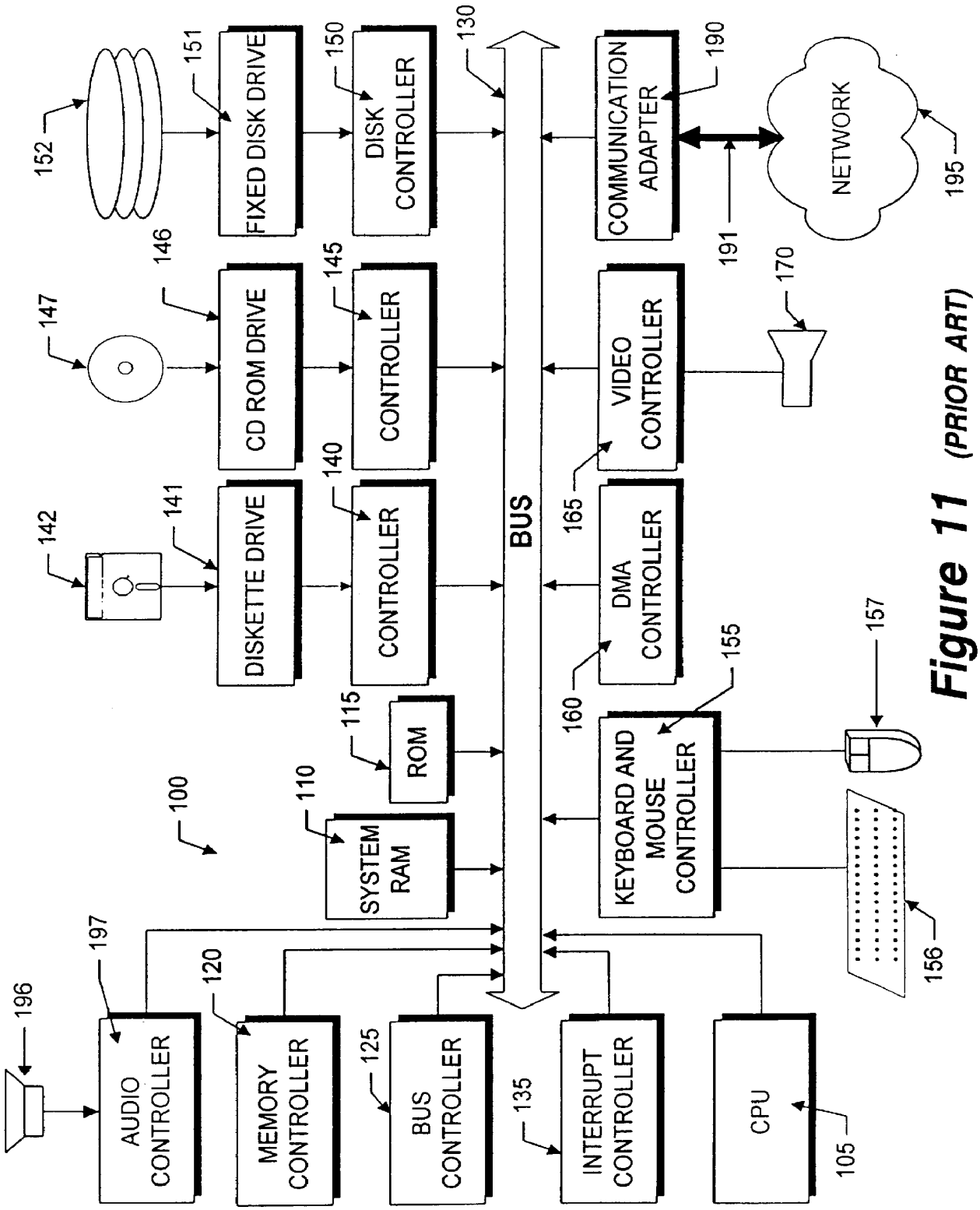


Figure 11 *(PRIOR ART)*

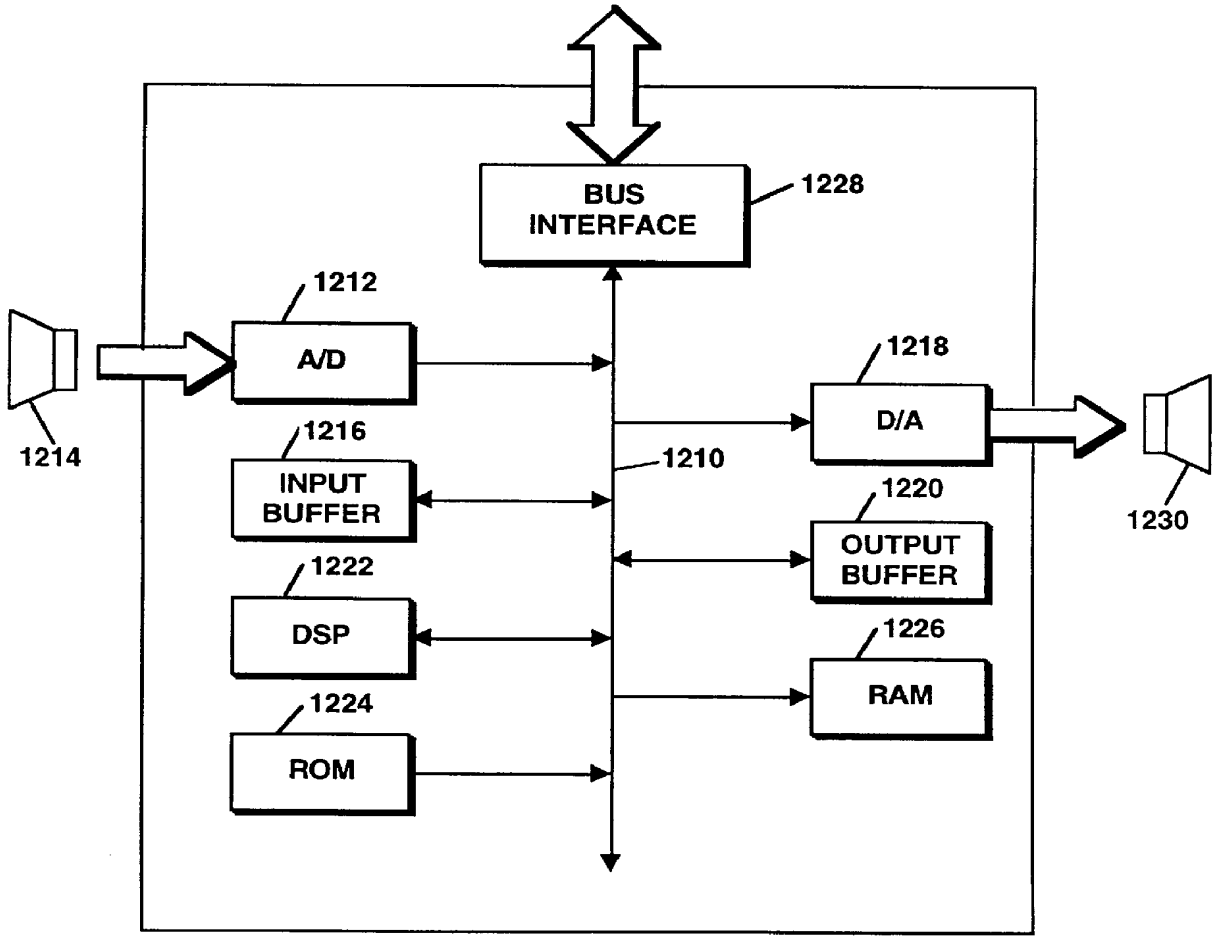


FIGURE 12 (PRIOR ART)

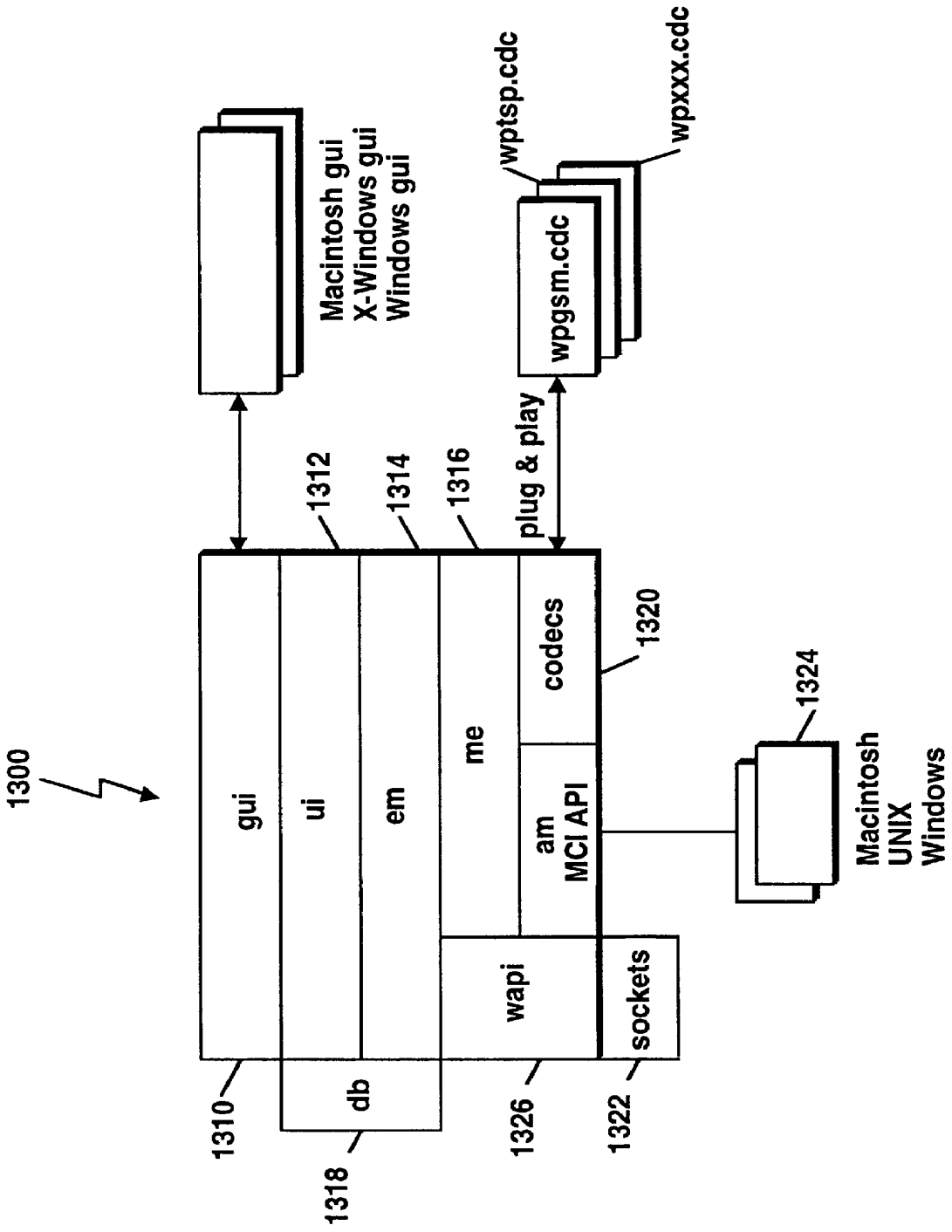

1300
gui
ui
em
me
codecs
am
MCI API
wapi
sockets
db
1310
1312
1314
1316
1318
1320
1322
1324
1326
Macintosh gui
X-Windows gui
Windows gui
plug & play
wpgsm.cdc
wptsp.cdc
wpxxx.cdc
Macintosh
UNIX
Windows

Figure 13 A

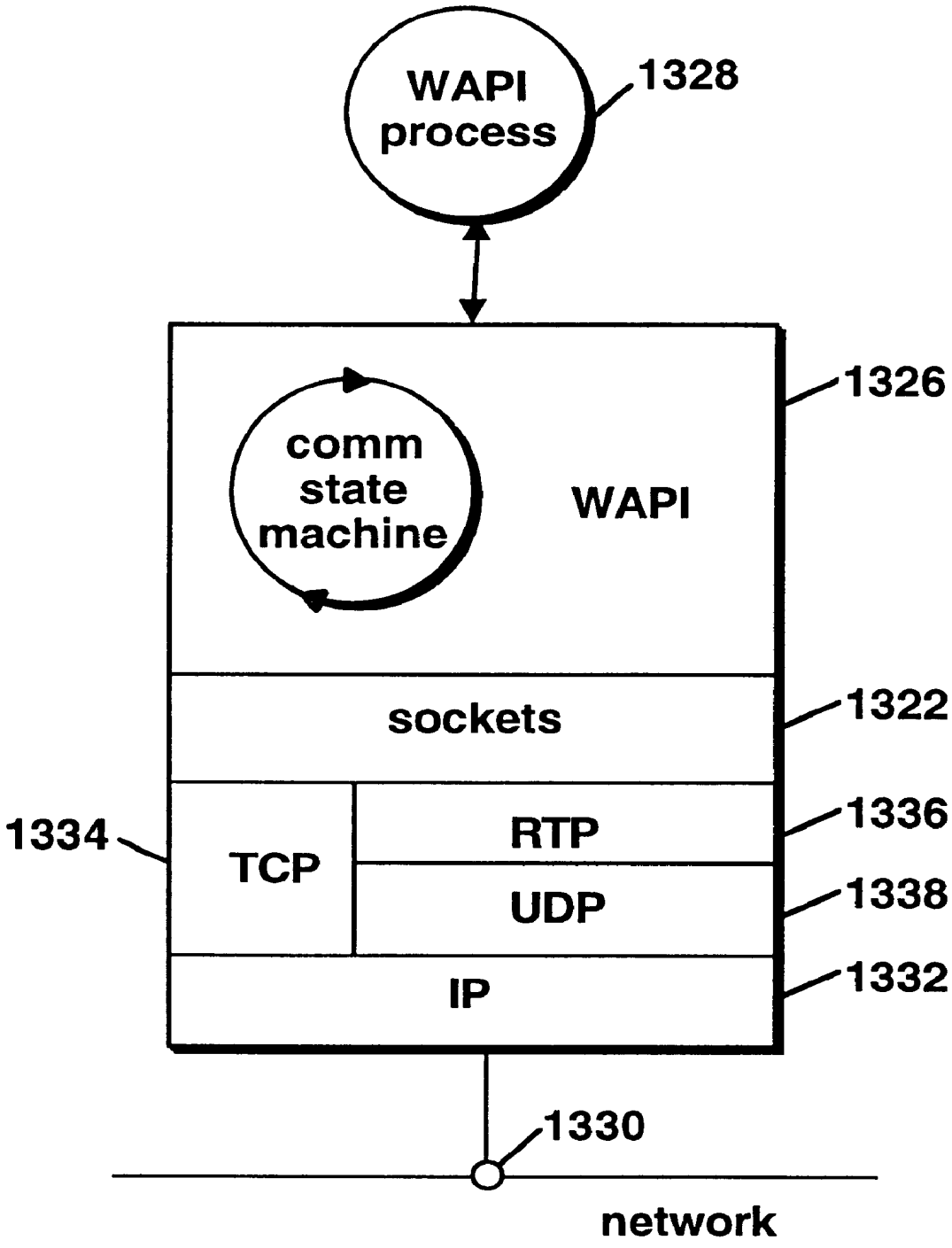

WAPI process
1328
1326
comm state machine
WAPI
sockets
1322
1334
TCP
RTP
1336
UDP
1338
IP
1332
1330
network

FIGURE 13 B

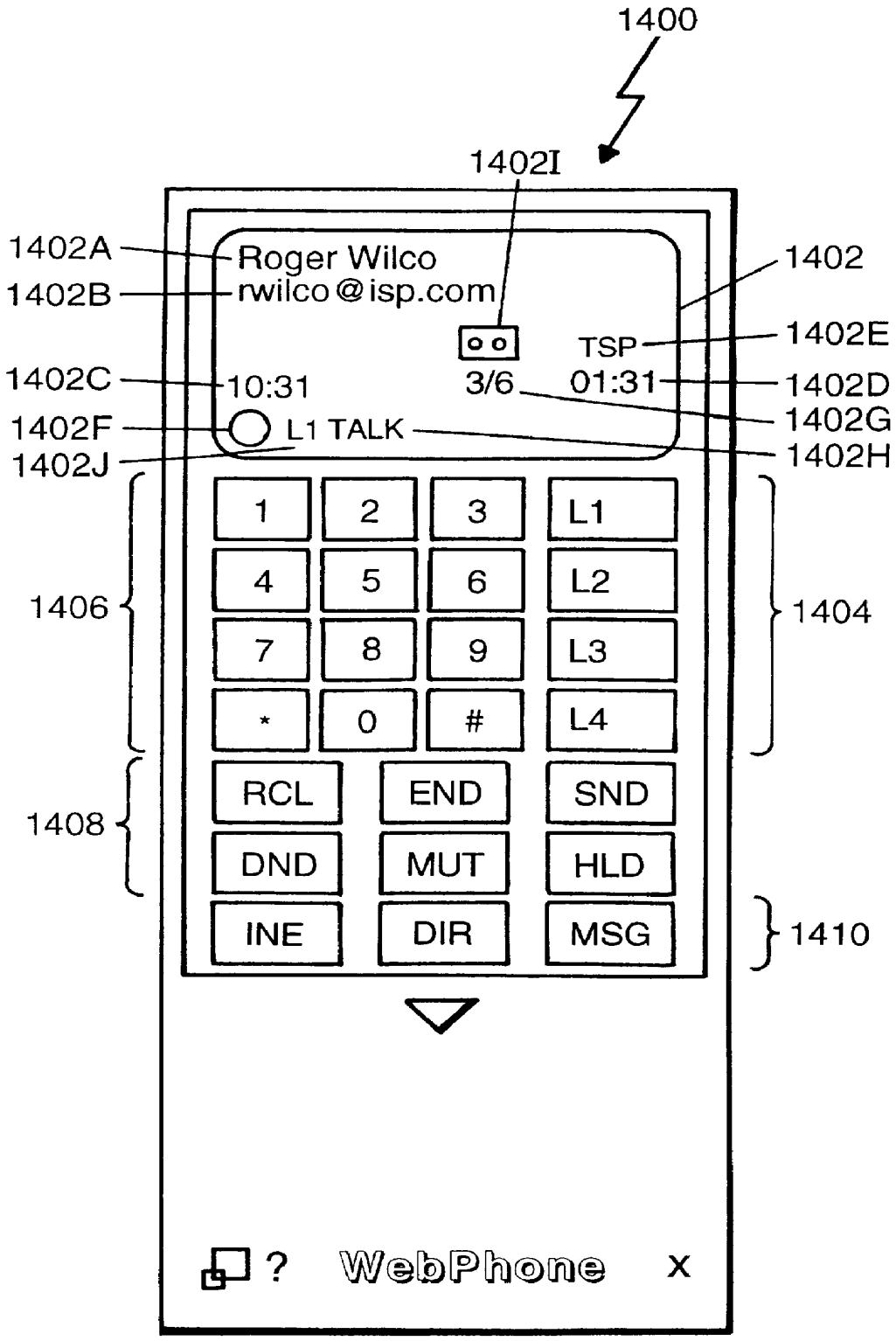

1400
1402I
1402A
Roger Wilco
1402B
rwilco@isp.com
1402
1402E
TSP
1402C
10:31
3/6
01:31
1402D
1402G
1402F
L1 TALK
1402H
1402J
1406
1404
1408
1410
1 2 3 L1
4 5 6 L2
7 8 9 L3
* 0 # L4
RCL END SND
DND MUT HLD
INE DIR MSG
? WebPhone X

Figure 14

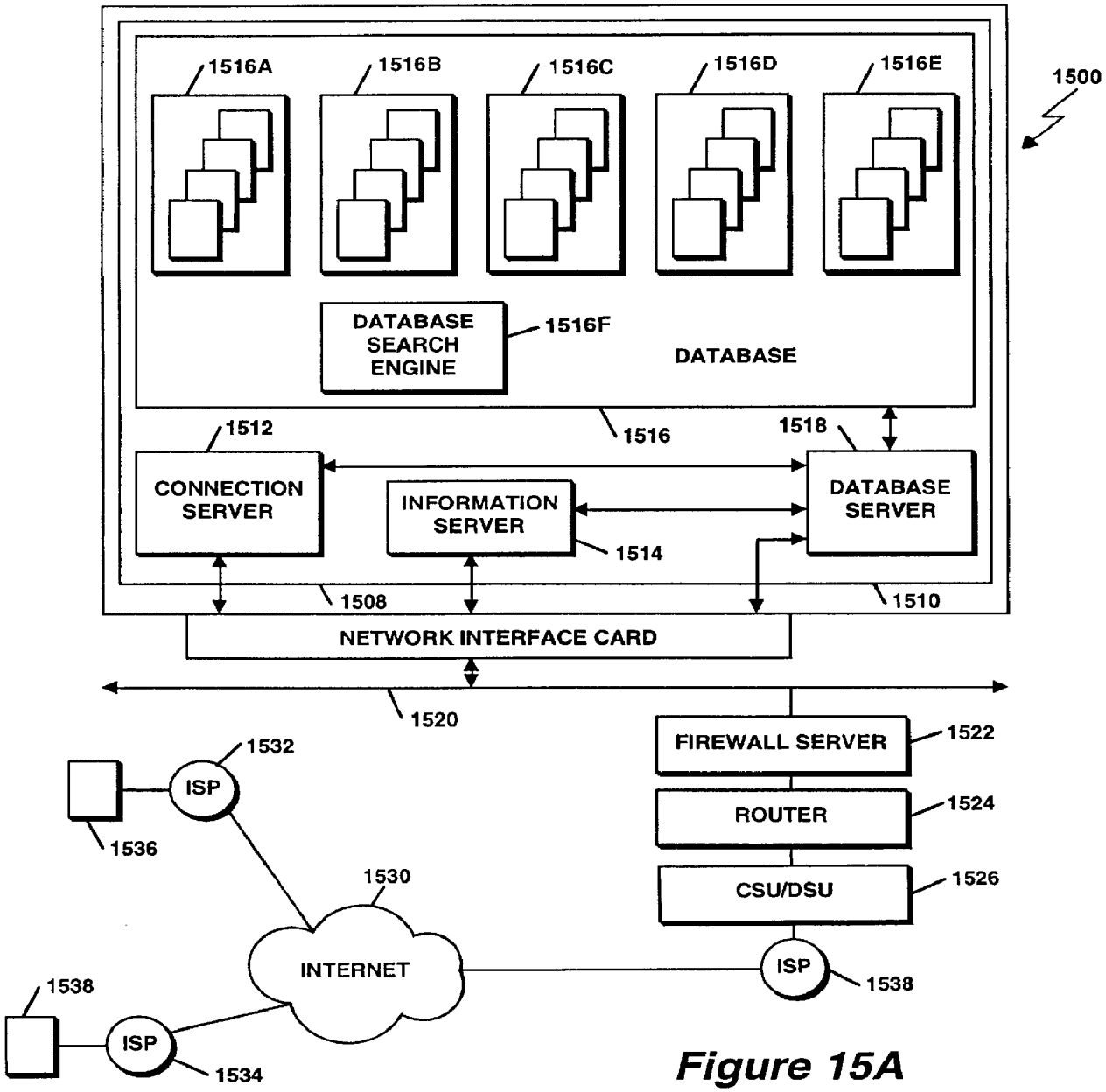

1500
1516A
1516B
1516C
1516D
1516E
DATABASE SEARCH ENGINE
1516F
DATABASE
1516
1512
CONNECTION SERVER
INFORMATION SERVER
1514
1518
DATABASE SERVER
1508
1510
NETWORK INTERFACE CARD
1520
1532
ISP
1536
1530
INTERNET
1538
ISP
1534
FIREWALL SERVER
1522
ROUTER
1524
CSU/DSU
1526
ISP
1538

Figure 15A

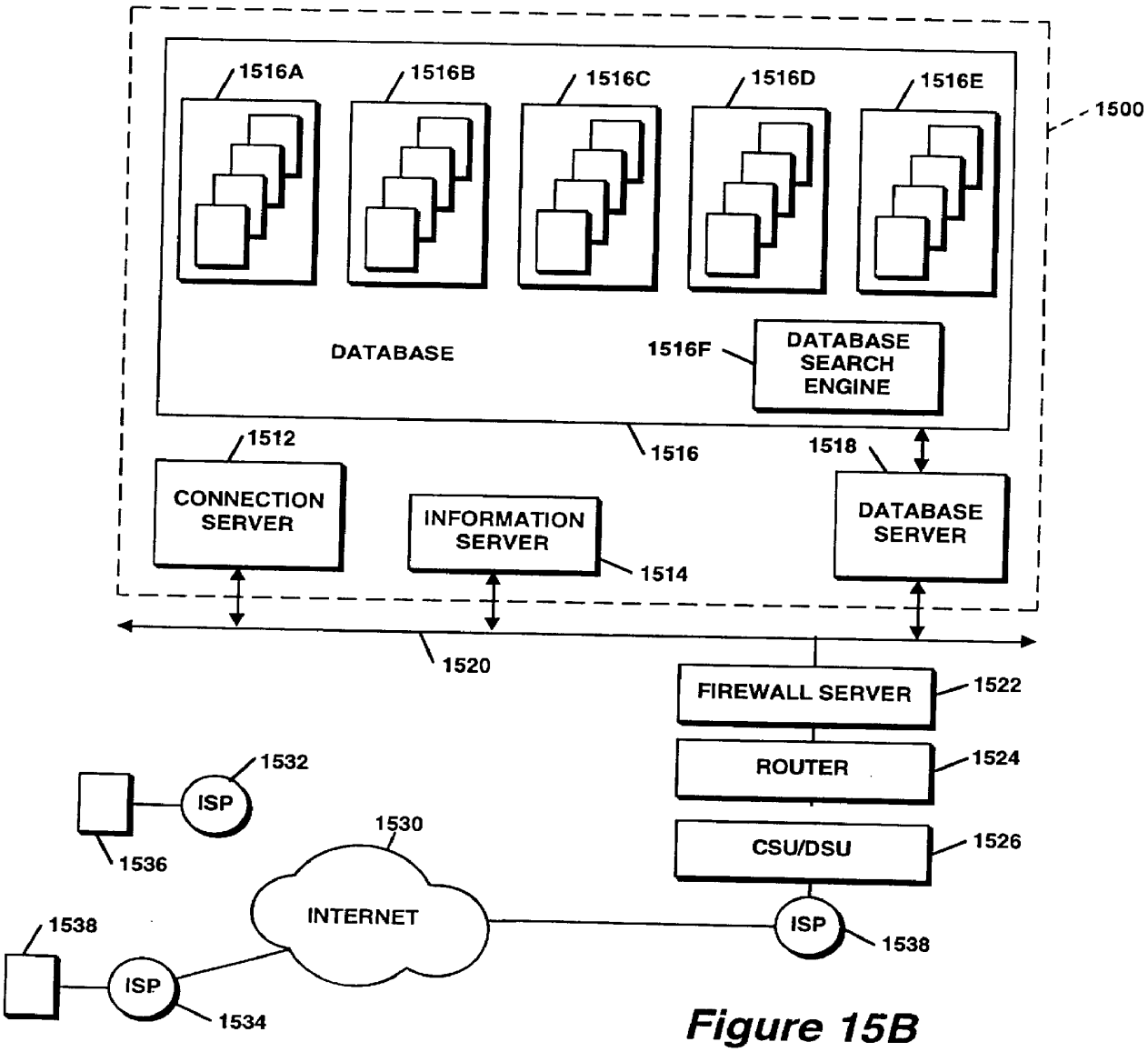

1516A
1516B
1516C
1516D
1516E
1500
DATABASE
1516F
DATABASE SEARCH ENGINE
1516
1512
CONNECTION SERVER
INFORMATION SERVER
1514
1518
DATABASE SERVER
1520
FIREWALL SERVER
1522
ROUTER
1524
CSU/DSU
1526
ISP
1538
1532
ISP
1536
1530
INTERNET
1538
ISP
1534

Figure 15B

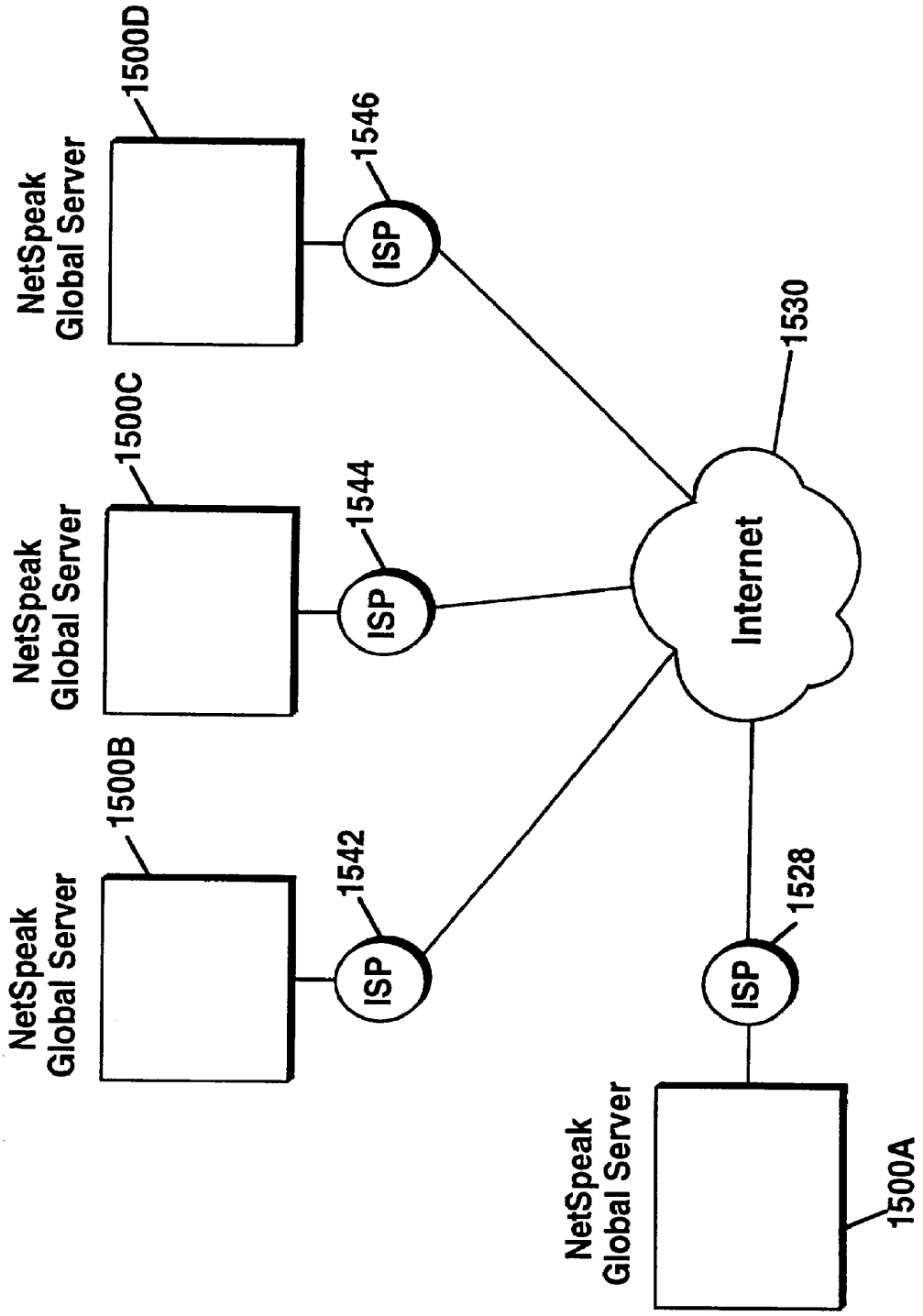

NetSpeak Global Server
1500D
1546
ISP
NetSpeak Global Server
1500C
1544
ISP
NetSpeak Global Server
1500B
1542
ISP
Internet
1530
ISP
1528
NetSpeak Global Server
1500A

Figure 15C

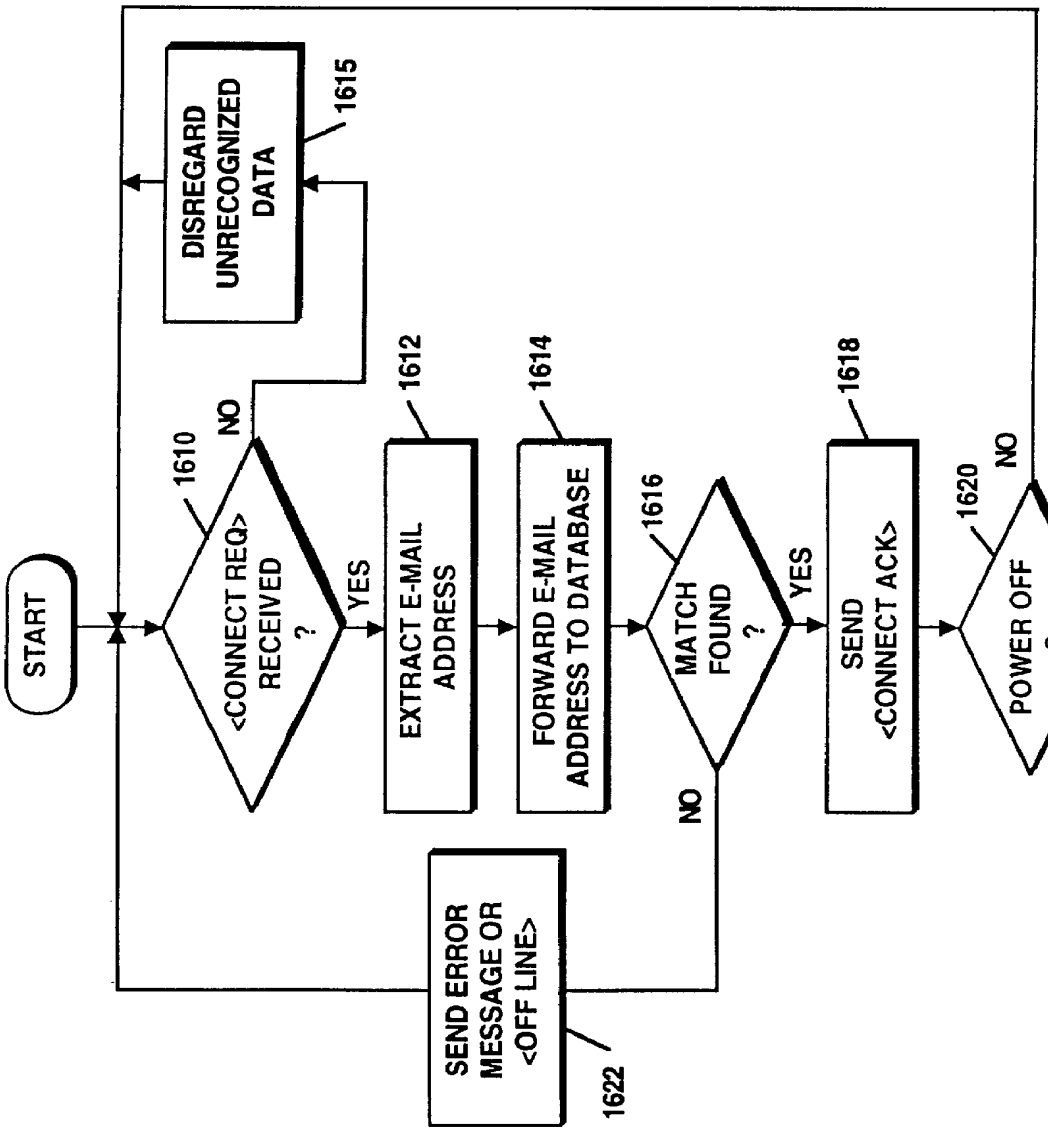

START
<CONNECT REQ> RECEIVED ?
1610
NO
YES
DISREGARD UNRECOGNIZED DATA
1615
EXTRACT E-MAIL ADDRESS
1612
FORWARD E-MAIL ADDRESS TO DATABASE
1614
MATCH FOUND ?
1616
NO
YES
SEND ERROR MESSAGE OR <OFF LINE>
1622
SEND <CONNECT ACK>
1618
POWER OFF ?
1620
NO
YES
END

Figure 16A

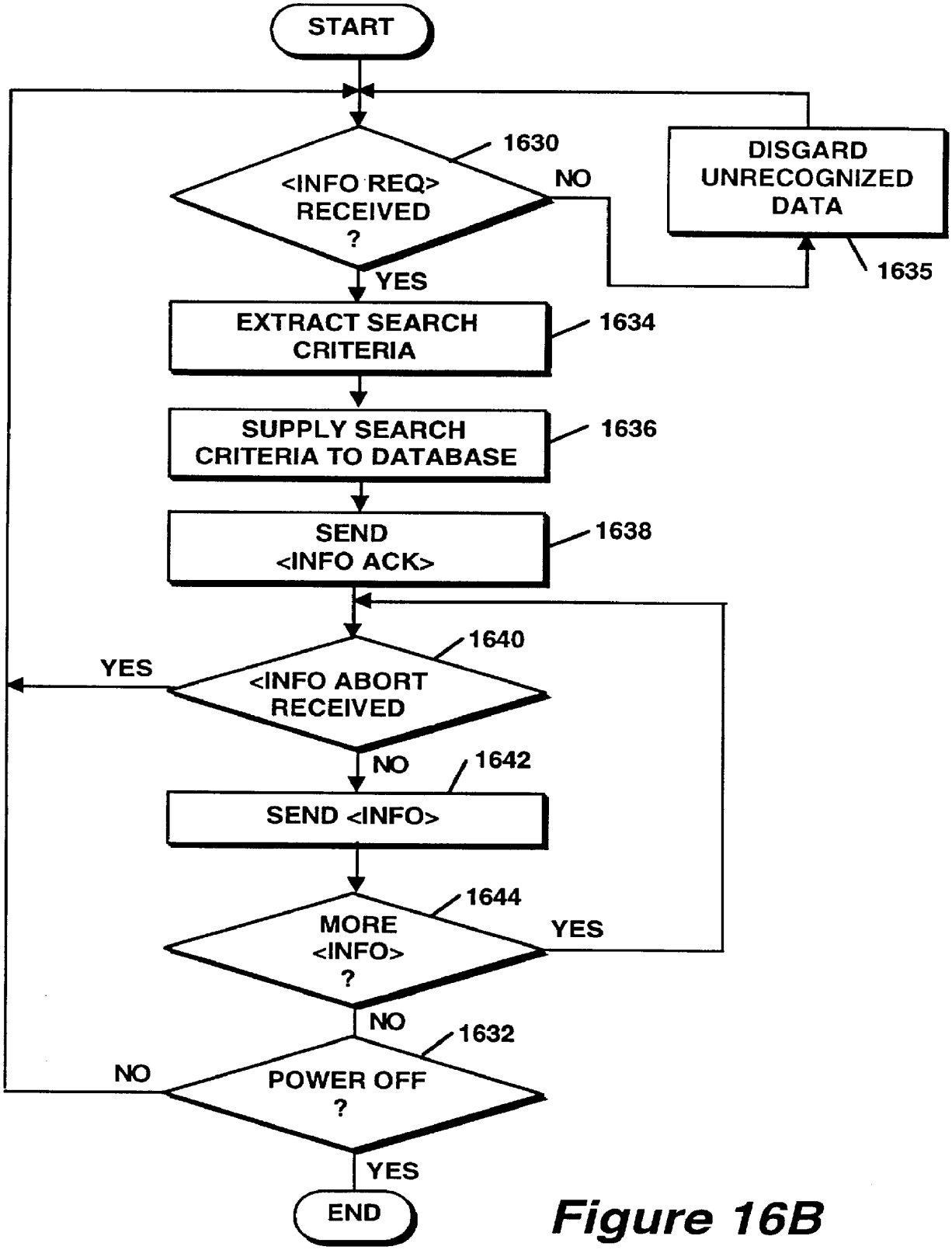

START
<INFO REQ> RECEIVED ?
1630
NO
DISGARD UNRECOGNIZED DATA
1635
YES
EXTRACT SEARCH CRITERIA
1634
SUPPLY SEARCH CRITERIA TO DATABASE
1636
SEND <INFO ACK>
1638
1640
YES
<INFO ABORT RECEIVED
NO
1642
SEND <INFO>
1644
MORE <INFO> ?
YES
NO
1632
NO
POWER OFF ?
YES
END

Figure 16B

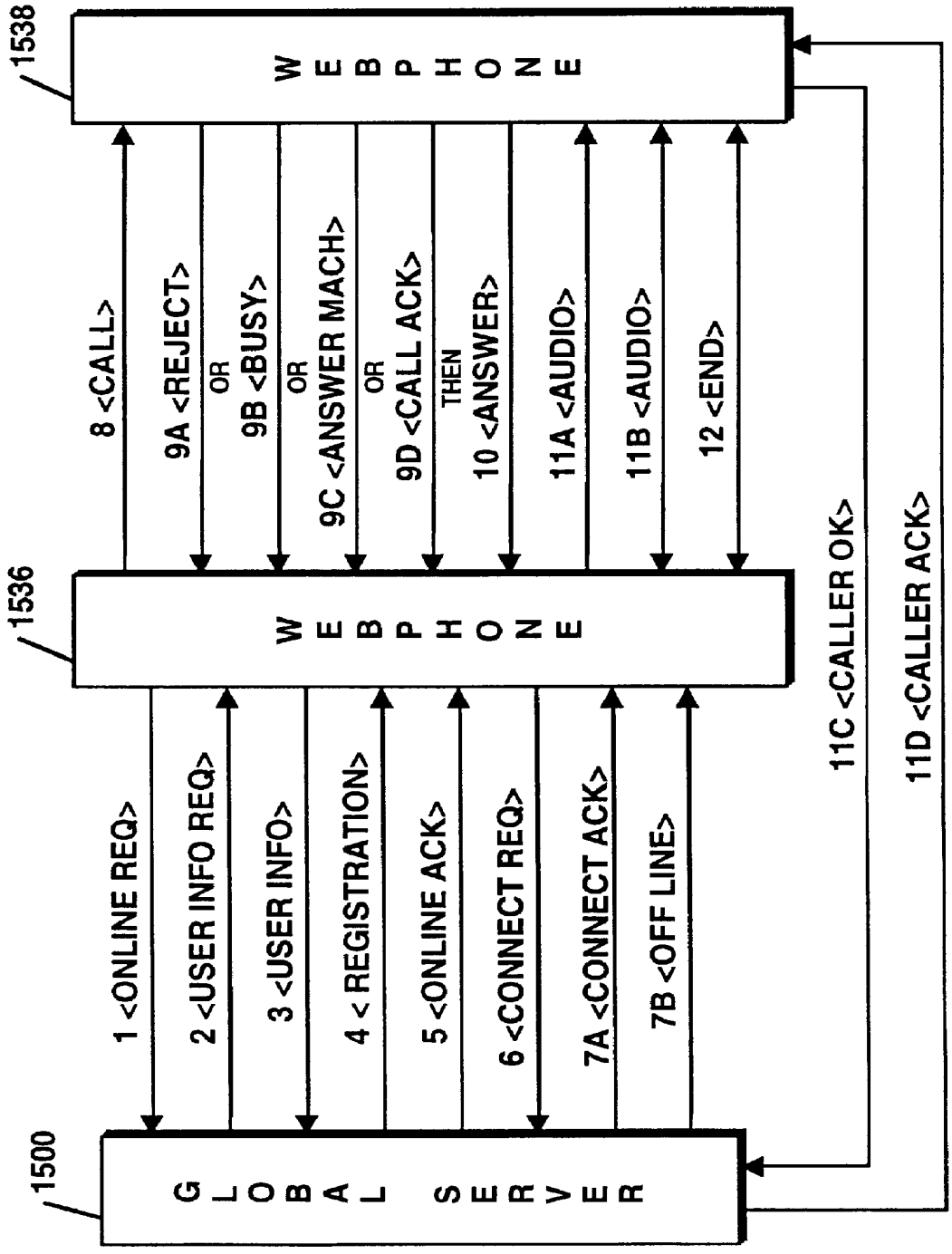

1538
WEBPHONE
1536
WEBPHONE
1500
GLOBAL SERVER
8 <CALL>
9A <REJECT>
OR
9B <BUSY>
OR
9C <ANSWER MACH>
OR
9D <CALL ACK>
THEN
10 <ANSWER>
11A <AUDIO>
11B <AUDIO>
12 <END>
1 <ONLINE REQ>
2 <USER INFO REQ>
3 <USER INFO>
4 < REGISTRATION>
5 <ONLINE ACK>
6 <CONNECT REQ>
7A <CONNECT ACK>
7B <OFF LINE>
11C <CALLER OK>
11D <CALLER ACK>

Figure 17A

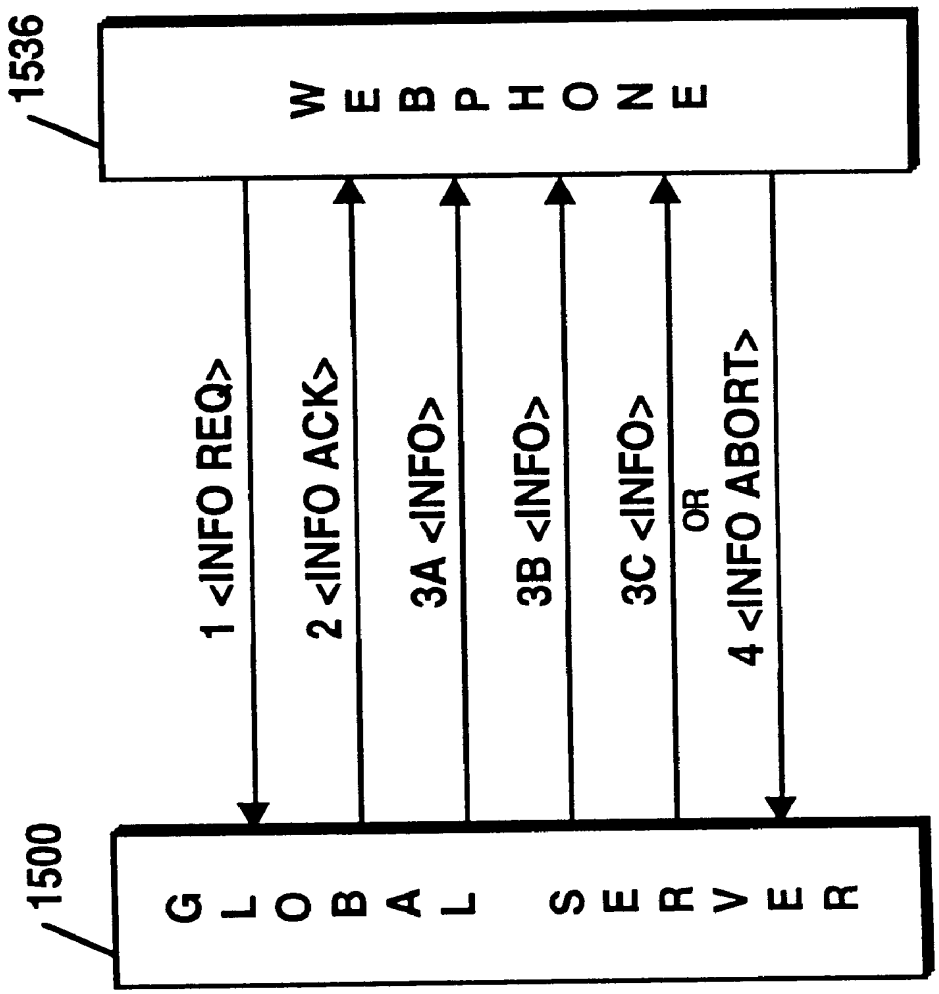

1536
WEBPHONE
1 <INFO REQ>
2 <INFO ACK>
3A <INFO>
3B <INFO>
3C <INFO>
OR
4 <INFO ABORT>
1500
GLOBAL SERVER

Figure 17B

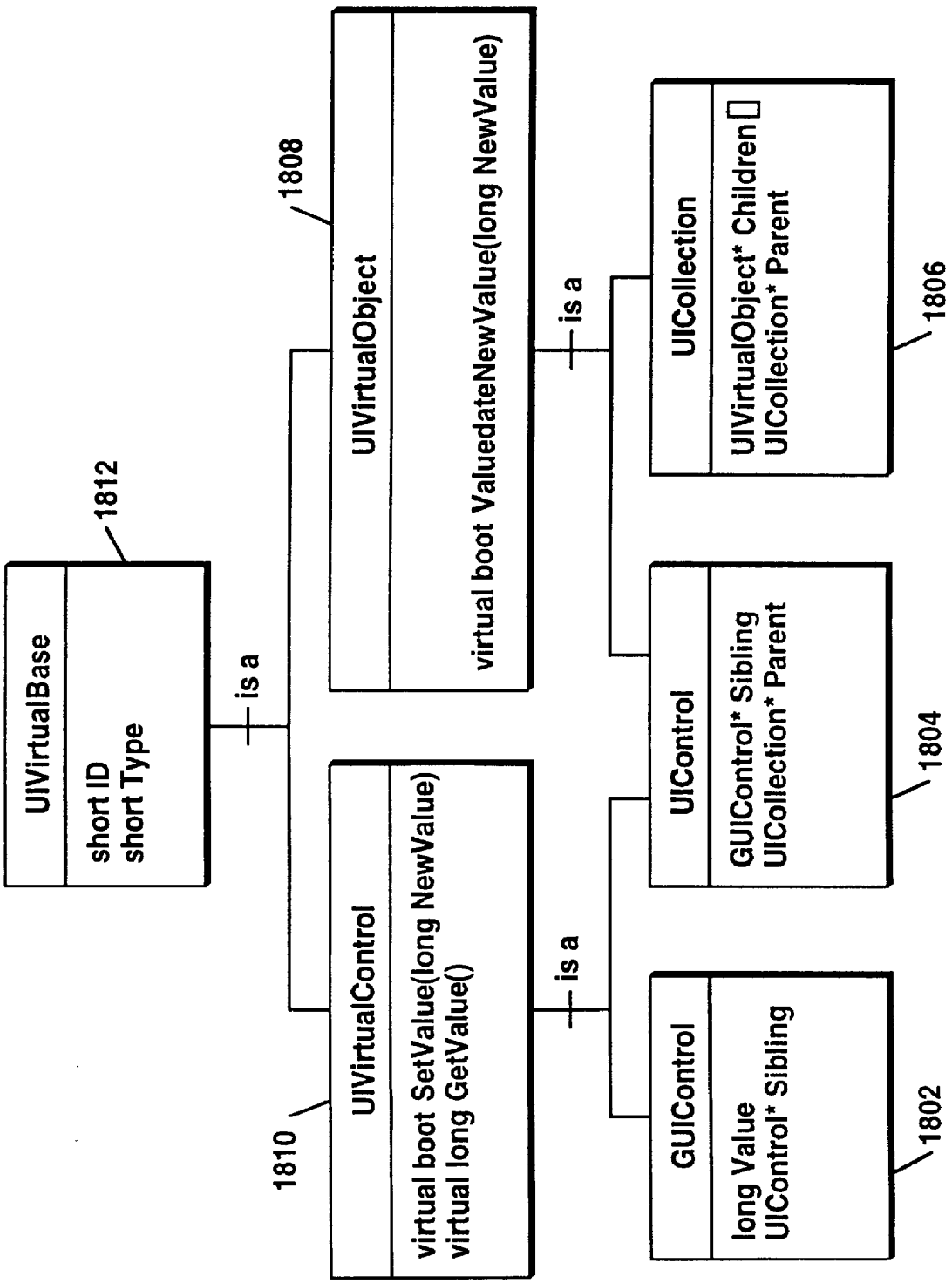

UIVirtualBase
short ID
short Type
1812
is a
UIVirtualObject
virtual boot ValuedateNewValue(long NewValue)
1808
UIVirtualControl
virtual boot SetValue(long NewValue)
virtual long GetValue()
1810
is a
UIControl
GUIControl* Sibling
UICollection* Parent
1804
GUIControl
long Value
UIControl* Sibling
1802
is a
UICollection
UIVirtualObject* Children[]
UICollection* Parent
1806

Figure 18A

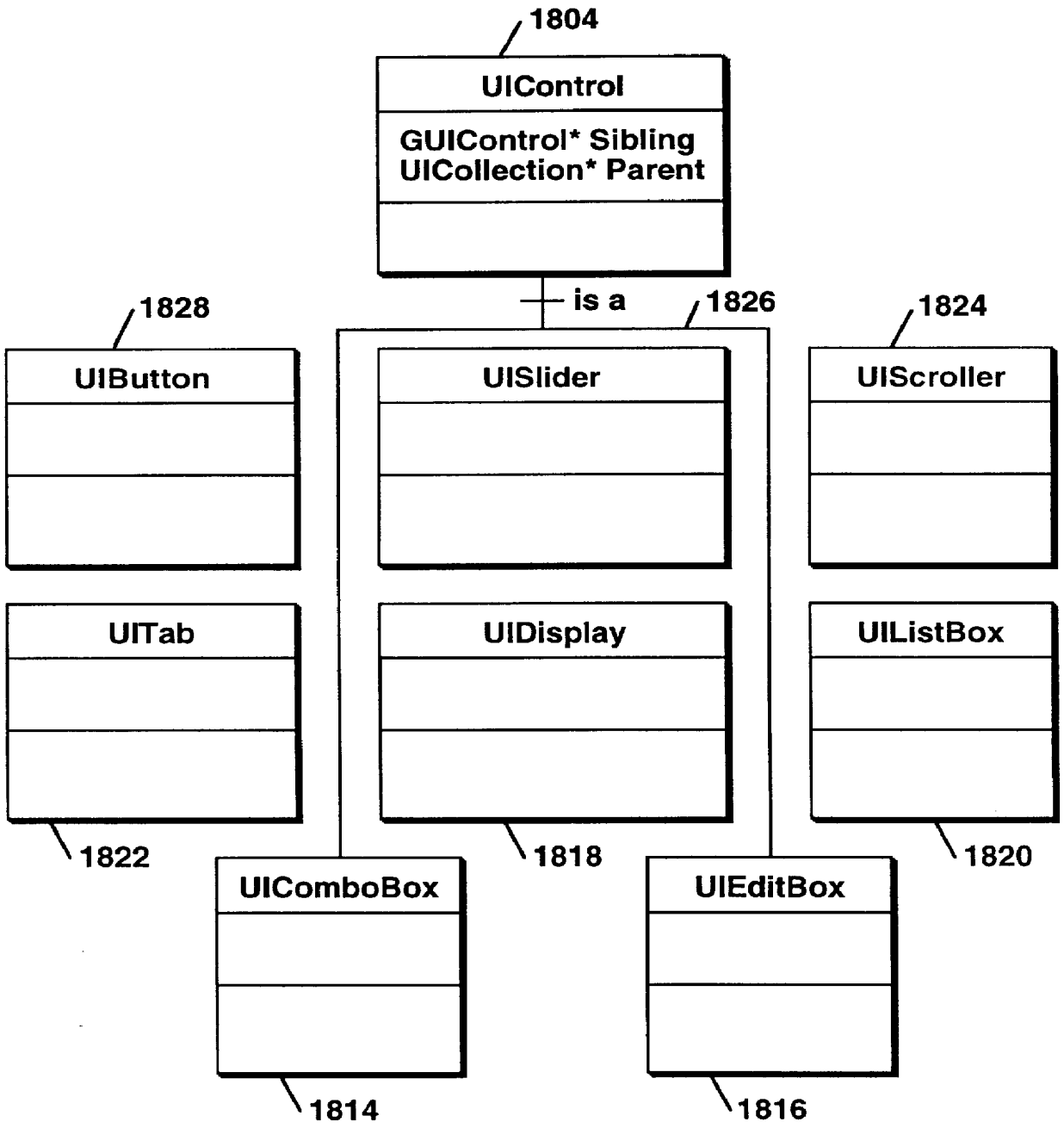

1804
UIControl
GUIControl* Sibling
UICollection* Parent
is a
1828
UIButton
1826
UISlider
1824
UIScroller
UITab
UIDisplay
UIListBox
1822
1818
1820
UIComboBox
UIEditBox
1814
1816

Figure 18B

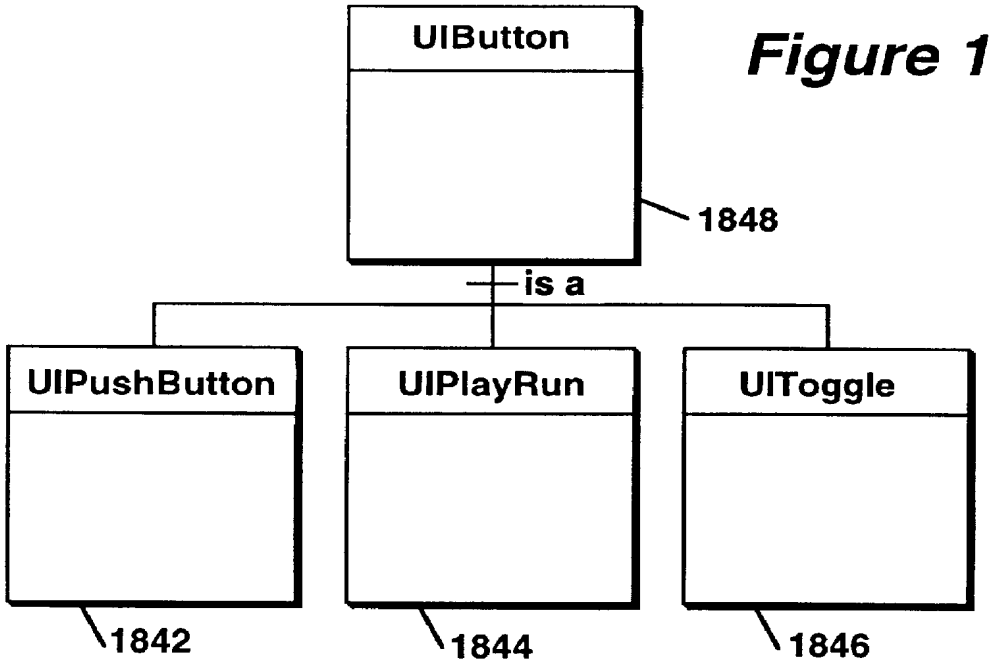


Figure 18C

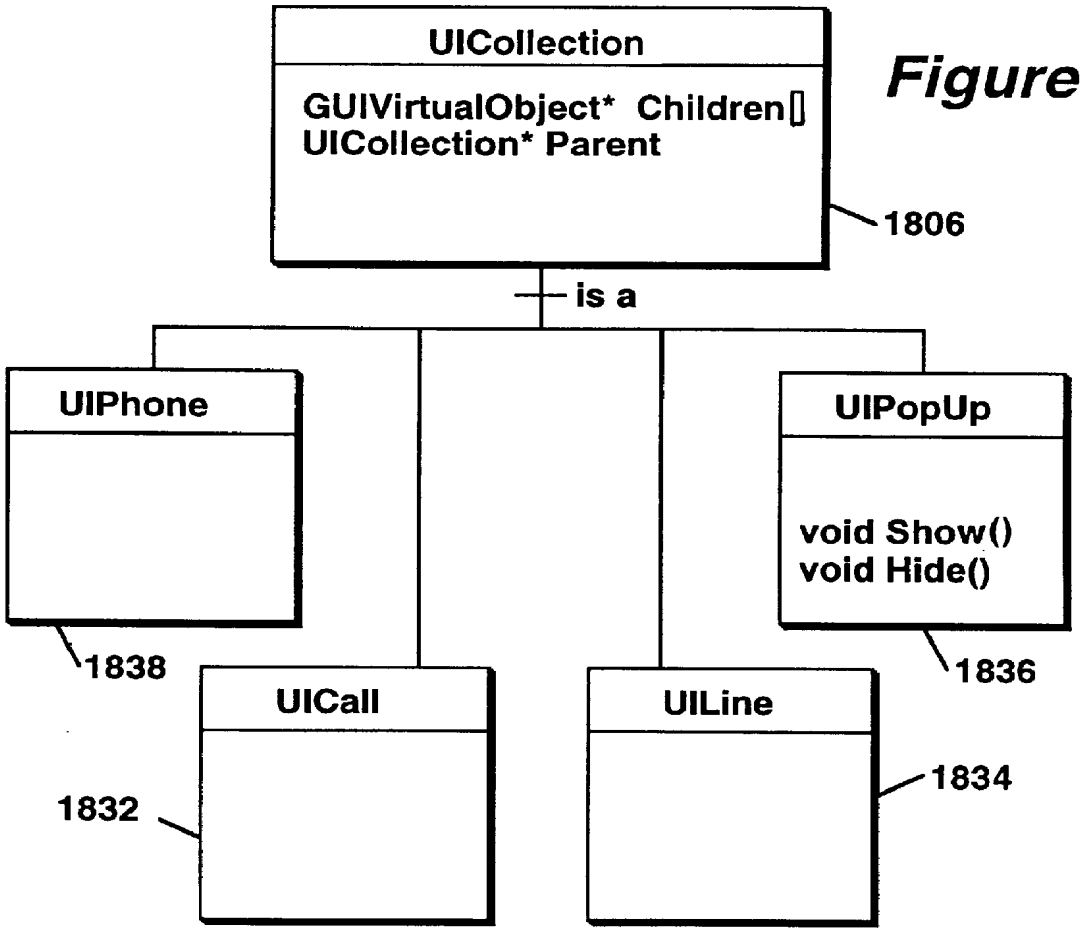


Figure 18D

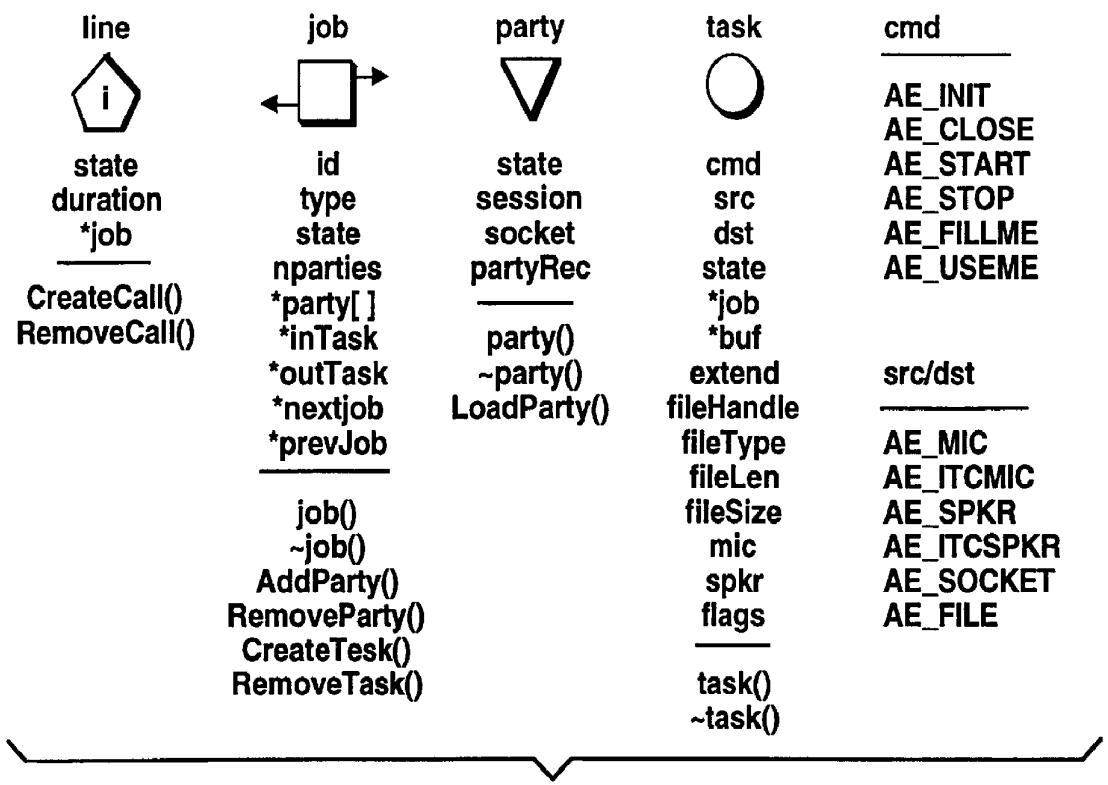


Figure 19A

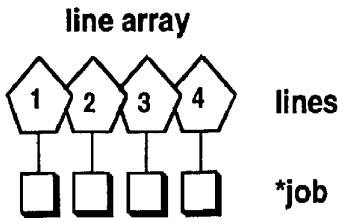


Figure 19B

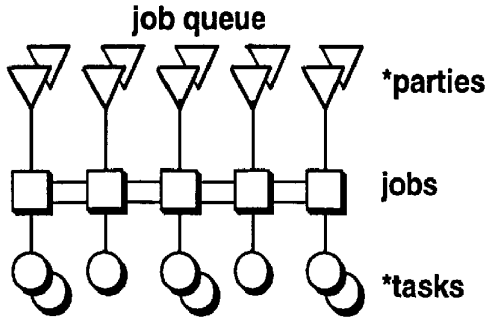


Figure 19C

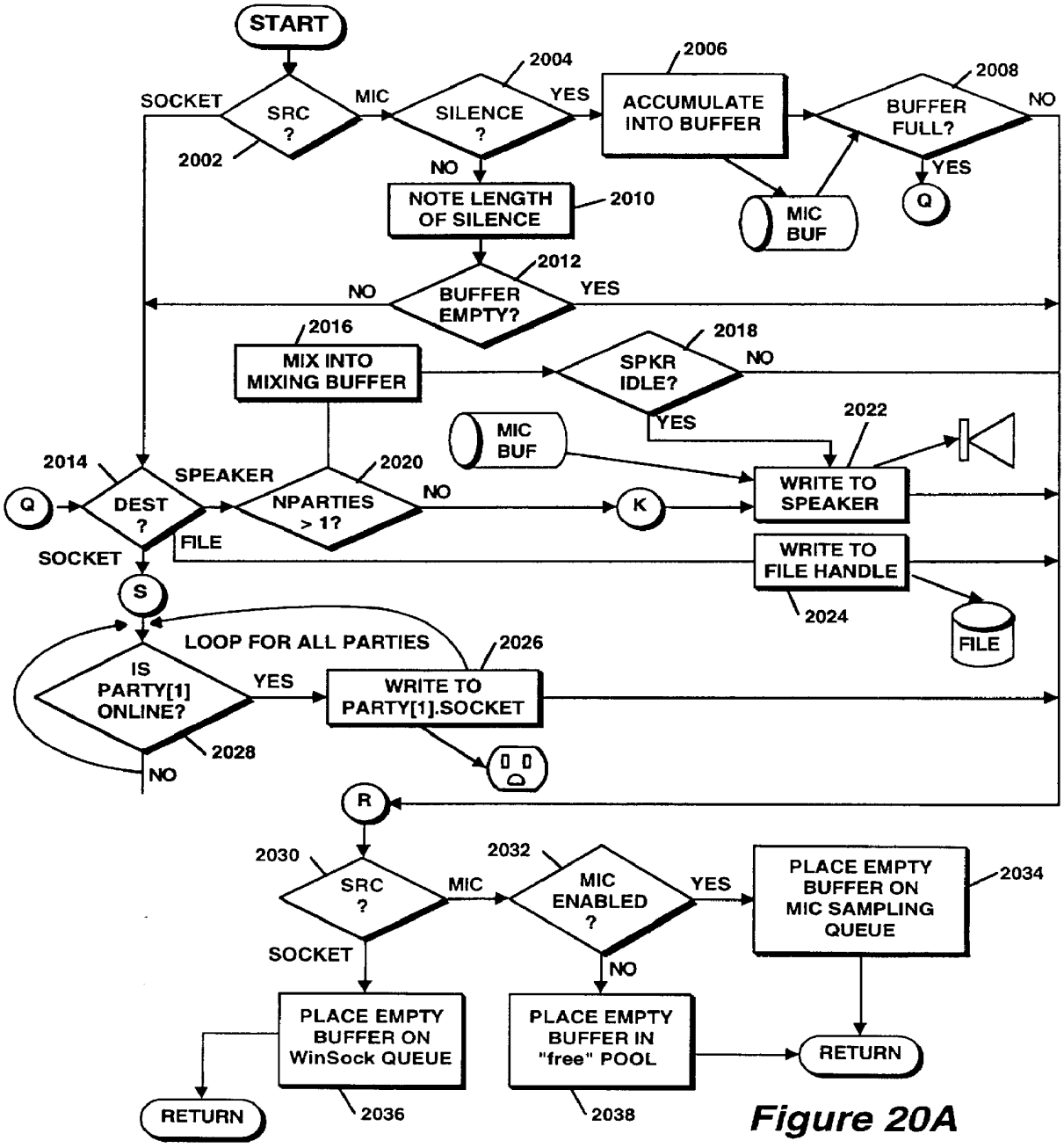

START
SRC ?
2002
SOCKET
MIC
SILENCE ?
2004
YES
NO
ACCUMULATE INTO BUFFER
2006
BUFFER FULL?
2008
NO
YES
Q
MIC BUF
NOTE LENGTH OF SILENCE
2010
BUFFER EMPTY?
2012
NO
YES
MIX INTO MIXING BUFFER
2016
SPKR IDLE?
2018
NO
YES
MIC BUF
2022
WRITE TO SPEAKER
Q
DEST ?
2014
SPEAKER
FILE
SOCKET
NPARTIES > 1?
2020
NO
K
WRITE TO FILE HANDLE
2024
FILE
S
LOOP FOR ALL PARTIES
IS PARTY[1] ONLINE?
YES
NO
2028
WRITE TO PARTY[1].SOCKET
2026
R
SRC ?
2030
MIC
SOCKET
MIC ENABLED ?
2032
YES
NO
PLACE EMPTY BUFFER ON MIC SAMPLING QUEUE
2034
PLACE EMPTY BUFFER ON WinSock QUEUE
2036
PLACE EMPTY BUFFER IN "free" POOL
2038
RETURN
RETURN

Figure 20A

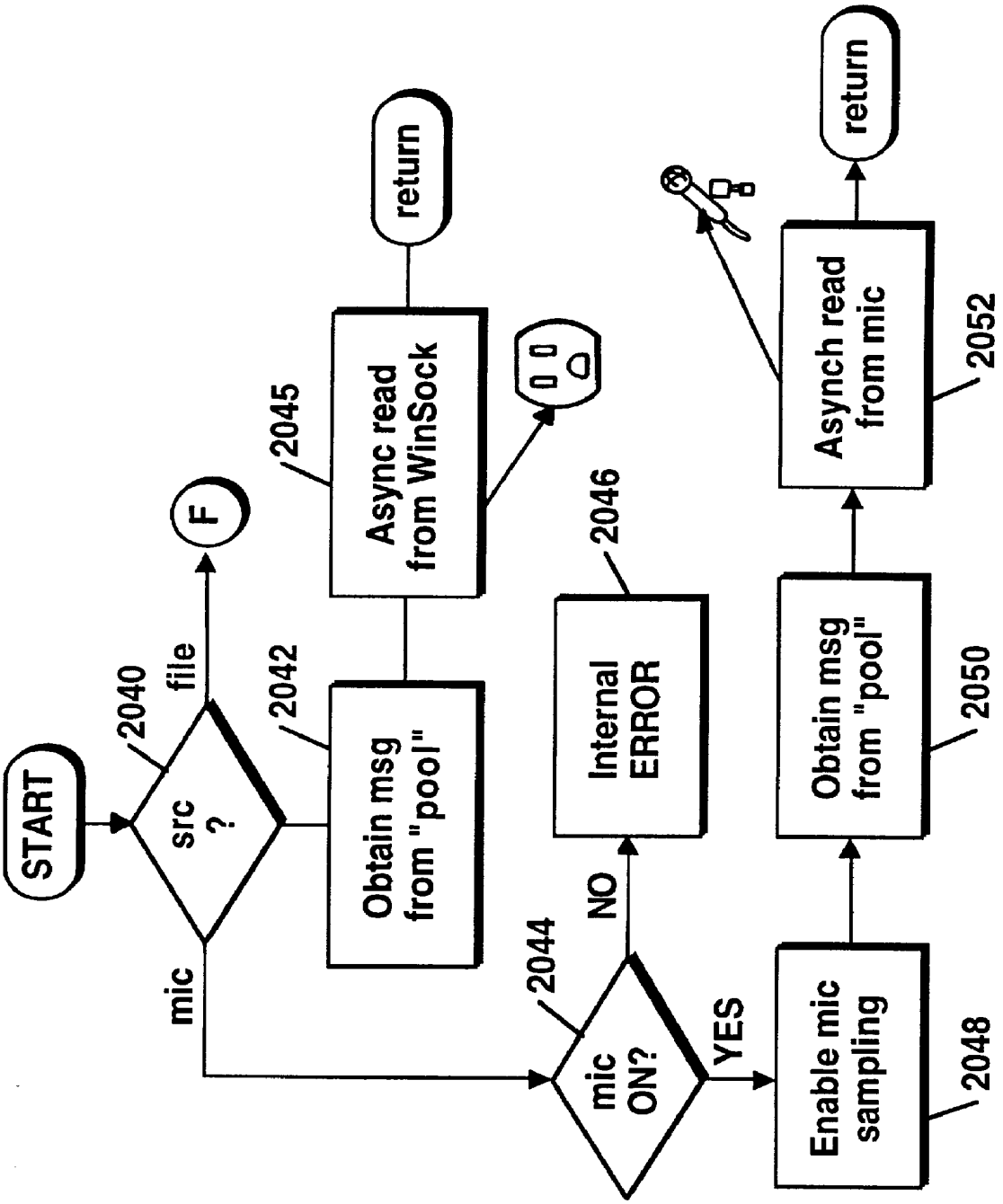

START
2040
src ?
file
F
mic
2042
Obtain msg from "pool"
2045
Async read from WinSock
return
2044
mic ON?
NO
2046
Internal ERROR
YES
Enable mic sampling
2048
Obtain msg from "pool"
2050
Asynch read from mic
2052
return

Figure 20B

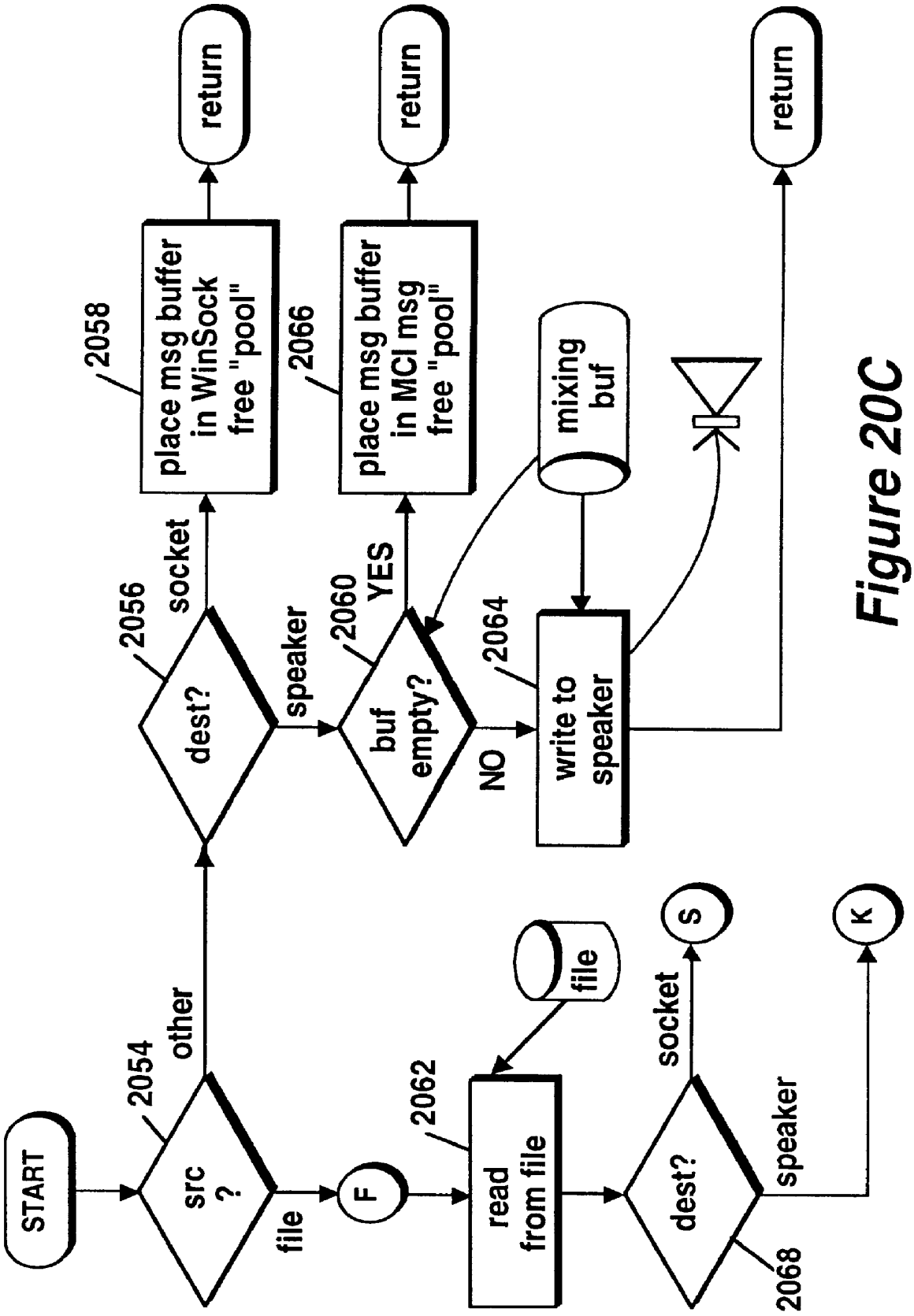

START
src ?
2054
other
file
F
read from file
2062
file
socket
S
dest?
2068
speaker
K
dest?
2056
socket
speaker
2058
place msg buffer in WinSock free "pool"
return
buf empty?
2060
YES
NO
2066
place msg buffer in MCI msg free "pool"
return
write to speaker
2064
mixing buf
return

Figure 20C

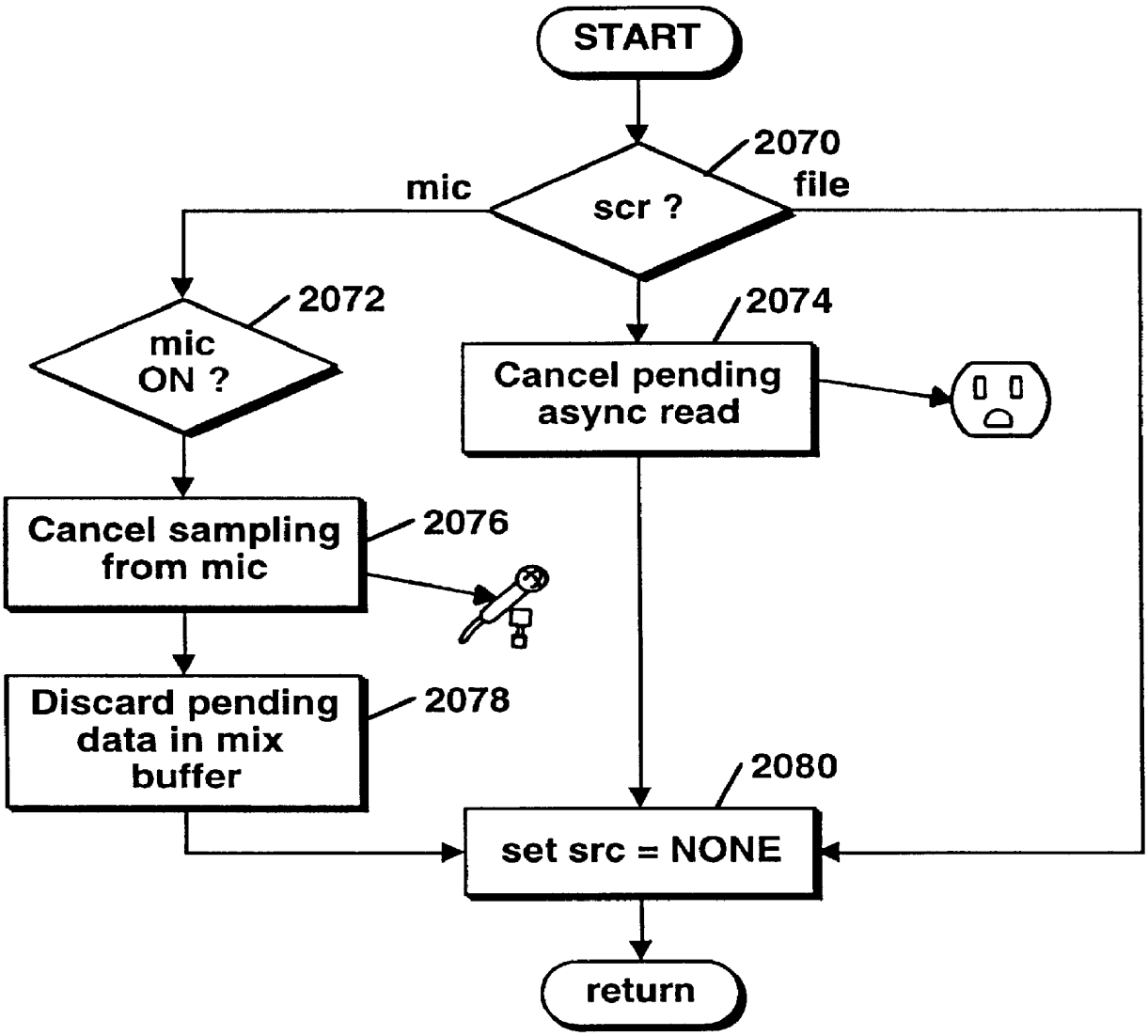

START
2070
scr ?
mic
file
2072
mic ON ?
2074
Cancel pending async read
Cancel sampling from mic
2076
Discard pending data in mix buffer
2078
2080
set src = NONE
return

Figure 20D

GRAPHIC USER INTERFACE FOR INTERNET TELEPHONY APPLICATION

RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. No. 08/533,115 (Pending) entitled Point-to-Point Internet Protocol, by Glenn W. Hutton, filed Sep. 25, 1995, commonly assigned, the subject matter of which is incorporated herein by reference.

To the extent that any matter contained herein is not already disclosed in the above-identified parent application a location claims priority to U.S. provisional patent application 60/025,415 entitled Internet Telephony Apparatus and Method by Mattaway et al., filed Sep. 4, 1996, and U.S. provisional patent application Ser. No. 60/024,251 entitled System and Methods for Point-To-Point Communications Over a Computer Network, by Mattaway et al., filed Aug. 21, 1996.

In addition, this application is one of a number of related applications filed on an even date herewith and commonly assigned, the subject matters of which are incorporated herein by reference, including the following:

- U.S. patent application Ser. No. 08/719,894, entitled Directory Server For Providing Dynamically Assigned Network Protocol Addresses, by Mattaway et al.;
- U.S. patent application Ser. No. 08/719,554, entitled Point-to-point Computer Network Communication Utility Utilizing Dynamically Assigned Network Protocol Addresses, by Mattaway et al.;
- U.S. patent application Ser. No. 08/719,640, entitled Method And Apparatus For Dynamically Defining Data Communication Utilities, by Mattaway et al.;
- U.S. patent application Ser. No. 08/719,891, entitled Method And Apparatus For Distribution And Presentation Of Multimedia Data Over A Computer Network, by Mattaway et al.;
- U.S. patent application Ser. No. 08/719,898, entitled Method And Apparatus For Providing Caller Identification Based Out-going Messages In A Computer Telephony Environment, by Mattaway et al.;
- U.S. patent application Ser. No. 08/718,911, entitled Method And Apparatus For Providing Caller Identification Based Call Blocking In A Computer Telephony Environment, by Mattaway et al.; and
- U.S. patent application Ser. No. 08/719,639, entitled Method And Apparatus For Providing Caller Identification Responses In A Computer Telephony Environment, by Mattaway et al.

FIELD OF THE INVENTION

The present invention relates, in general, to data processing systems, and more specifically, to a method and apparatus for facilitating audio communications over computer networks.

BACKGROUND OF THE INVENTION

The increased popularity of on-line services such as AMERICA ONLINE™, COMPUSERVE®, and other services such as Internet gateways have spurred applications to provide multimedia, including video and voice clips, to online users. An example of an online voice clip application is VOICE E-MAIL FOR WINCIM and VOICE E-MAIL FOR AMERICA ONLINE™, available from Bonzi Software, as described in "Simple Utilities Send Voice E-Mail Online", MULTIMEDIA WORLD, VOL. 2, NO. 9, Aug. 1995, p. 52. Using such Voice E-Mail software, a user may create an audio message to be sent to a predetermined E-mail address specified by the user.

Generally, devices interfacing to the Internet and other online services may communicate with each other upon establishing respective device addresses. One type of device address is the Internet Protocol (IP) address, which acts as a pointer to the device associated with the IP address. A typical device may have a Serial Line Internet Protocol or Point-to-Point Protocol (SLIP/PPP) account with a permanent IP address for receiving E-mail, voicemail, and the like over the Internet. E-mail and voicemail is generally intended to convey text, audio, etc., with any routing information such as an IP address and routing headers generally being considered an artifact of the communication, or even gibberish to the recipient.

Devices such as a host computer or server of a company may include multiple modems for connection of users to the Internet, with a temporary IP address allocated to each user. For example, the host computer may have a general IP address "XXX.XXX.XXX," and each user may be allocated a successive IP address of XXX.XXX.XXX.10, XXX.XXX.XXX.11, XXX.XXX.XXX.12, etc. Such temporary IP addresses may be reassigned or recycled to the users, for example, as each user is successively connected to an outside party. For example, a host computer of a company may support a maximum of 254 IP addresses which are pooled and shared between devices connected to the host computer.

Permanent IP addresses of users and devices accessing the Internet readily support point-to-point communications of voice and video signals over the Internet. For example, real-time video teleconferencing has been implemented using dedicated IP addresses and mechanisms known as reflectors. Due to the dynamic nature of temporary IP addresses of some devices accessing the Internet, point-to-point communications in real-time of voice and video have been generally difficult to attain.

The ability to locate users having temporary or dynamically assigned Internet Protocol address has been difficult without the user manually initiating the communication. Accordingly, spontaneous, real-time communications with such users over computer networks have been impractical. Further, it is desirable to have a communication utility which contains familiar features and functions to current communication utility such as telephones and cellular telephones. It is even further desirable to utilize the current graphic user interface technology associated with computer software in a manner to achieve a more flexible interface to a such a communication utility, without the limitations associated with hardware.

Accordingly, a need exists for a way to determine whether computer users are actively connected to a computer network.

A further need exists for a way to obtain the dynamically assigned Internet Protocol address of a user having on-line status with respect to a computer network, particularly the Internet.

An even further need exists for a method and apparatus by which to establish real-time, point-to-point communications over a computer network using a communication utility having an interface which combines the familiar aspects of current hardware communication utilities but which allows for the flexibility associated with graphic user interfaces.

SUMMARY OF THE INVENTION

The above deficiencies in the prior art and previously described needs are fulfilled by the present invention which

provides a virtual communications utility displayable on computer system interfaces which enables real-time, point-to-point communications over computer networks. According to one embodiment of the present invention, a computer program product for use with a computer system having a display and an audio transducer comprises a computer usable medium having computer readable code means embodied therein comprising program code means for generating a user interface, program code means responsive to user input commands for establishing a point-to-point communication link with another computer over a network and program code means responsive to audio data from the audio transducer for transmitting the audio data over the communication link.

According to another embodiment of the present invention, a computer program product for use with a computer system comprises a computer usable medium having computer readable program code means embodied thereon comprising code means for transmitting from a client process to a server a query as to whether a second client process is connected to the computer network, program code means for receiving the network protocol address of the second process from the server, and program code means responsive to the network protocol address of the second client process for establishing a point-to-point communication link between the first client process and the second client process.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the invention will become more readily apparent and may be better understood by referring to the following detailed description of an illustrative embodiment of the present invention, taken in conjunction with the accompanying drawings, in which:

FIG. **1** illustrates, in block diagram format, a system for the disclosed point-to-point Internet protocol;

FIG. **2** illustrates, in block diagram format, the system using a secondary point-to-point Internet protocol;

FIG. **3** illustrates, in block diagram format, the system of FIGS. **1–2** with the point-to-point Internet protocol established;

FIG. **4** is another block diagram of the system of FIGS. **1–2** with audio communications being conducted;

FIG. **5** illustrates a display screen for a processing unit;

FIG. **6** illustrates another display screen for a processing unit;

FIG. **7** illustrates a flowchart of the initiation of the point-to-point Internet protocols;

FIG. **8** illustrates a flowchart of the performance of the primary point-to-point Internet protocols;

FIG. **9** illustrates a flowchart of the performance of the secondary point-to-point Internet protocol;

FIG. **10** illustrates schematically a computer network over which the present invention may be utilized;

FIG. **11** is a block diagram of a computer system suitable for use with the present invention;

FIG. **12** is a block diagram of an audio processing card suitable for use with the computer system of FIG. **10**;

FIGS. **13** A–B are schematic block diagrams of the elements comprising the inventive computer network telephony mechanism of the present invention;

FIG. **14** is a screen capture illustrating an exemplary user interface of the present invention;

FIG. **15** is a schematic diagram illustrating the architecture of the connection server apparatus suitable for use with the present invention;

FIG. **16A** is a flowchart illustrating the process steps performed by the connection server in accordance with the present invention;

FIG. **16B** is a flowchart illustrating the process steps performed in accordance with the information server of the present invention;

FIGS. **17A–B** are schematic block diagrams illustrating of the packet transfer sequence in accordance with the communication protocol of the present invention;

FIGS. **18A–D** are conceptual block diagrams illustrating user interface and graphic user interface objects utilized by the communication utility of the present invention;

FIGS. **19A–C** are conceptual block diagrams illustrating the event manager and media engine objects utilized by the communication utility of the present invention; and

FIGS. **20A–D** illustrate process steps performed by the media engine function of the communication utility in accordance with the present invention.

DETAILED DESCRIPTION

Referring now in specific detail to the drawings, with like reference numerals identifying similar or identical elements, as shown in FIG. **1**, the present disclosure describes a point-to-point network protocol and system **10** for using such a protocol.

In an exemplary embodiment, the system **10** includes a first processing unit **12** for sending at least a voice signal from a first user to a second user. The first processing unit **12** includes a processor **14**, a memory **16**, an input device **18**, and an output device **20**. The output device **20** includes at least one modem capable of, for example, 14.4 Kilobit-per-second communications and operatively connected via wired and/or wireless communication connections to the Internet or other computer networks such as an Intranet, i.e., a private computer network. One skilled in the art would understand that the input device **18** may be implemented at least in part by the modem of the output device **20** to allow input signals from the communication connections to be received. The second processing unit **22** may have a processor, memory, and input and output devices, including at least one modem and associated communication connections, as described above for the first processing unit **12**. In an exemplary embodiment, each of the processing units **12, 22** may execute the WEBPHONE® Internet telephony application available from NetSpeak Corporation, Boca Raton, Fla., which is capable of performing the disclosed point-to-point Internet protocol and system **10**, as described herein.

The first processing unit **12** and the second processing unit **22** are operatively connected to the Internet **24** by communication devices and software known in the art, such as an Internet Service Provider (ISP) or an Internet gateway. The processing units **12, 22** may be operatively interconnected through the Internet **24** to a connection server **26**, and may also be operatively connected to a mail server **28** associated with the Internet **24**.

The connection server **26** includes a processor **30**, a timer **32** for generating time stamps, and a memory such as a database **34** for storing, for example, E-mail and Internet Protocol (IP) addresses of logged-in units. In an exemplary embodiment, the connection server **26** may be a SPARC 5 server or a SPARC 20 server, available from SUN MICROSYSTEMS, INC., Mountain View, Calif., having a central processing unit (CPU) as processor **30**, an operating system (OS) such as UNIX, for providing timing operations

such as maintaining the timer **32**, a hard drive or fixed drive, as well as dynamic random access memory (DRAM) for storing the database **34**, and a keyboard and display and/or other input and output devices (not shown in FIG. **1**). The database **34** may be an SQL database available from ORACLE or INFORMIX.

In an exemplary embodiment, the mail server **28** may be implemented with a Post Office Protocol (POP) Version **3** mail server and the Simple Mail Transfer Protocol (SMTP), including a processor, memory, and stored programs operating in a UNIX environment, or, alternatively, another OS, to process E-mail capabilities between processing units and devices over the Internet **24**.

In the illustrative embodiment, the POP protocol is utilized to retrieve E-mail messages from mail server **28** while the SMTP protocol is used to submit E-mail message to Internet **24**.

The first processing unit **12** may operate the disclosed point-to-point Internet protocol by a computer program described hereinbelow in conjunction with FIG. **6**, which may be implemented from compiled and /or interpreted source code in the C++ programming language and which may be downloaded to the first processing unit **12** from an external computer. The operating computer program may be stored in the memory **16**, which may include about 8 MB RAM and/or a hard or fixed drive having about 8 MB of available memory. Alternatively, the source code may be implemented in the first processing unit **12** as firmware, as an erasable read only memory (EPROM), etc. It is understood that one skilled in the art would be able to use programming languages other than C++ to implement the disclosed point-to-point network protocol and system **10**.

The processor **14** receives input commands and data from a first user associated with the first processing unit **12** though the input device **18**, which may be an input port connected by a wired, optical, or a wireless connection for electromagnetic transmissions, or alternatively may be transferable storage media, such as floppy disks, magnetic tapes, compact disks, or other storage media including the input data from the first user.

The input device **18** may include a user interface (not shown) having, for example, at least one button actuated by the user to input commands to select from a plurality of operating modes to operate the first processing unit **12**. In alternative embodiments, the input device **18** may include a keyboard, a mouse, a touch screen, and/or a data reading device such as a disk drive for receiving the input data from input data files stored in storage media such as a floppy disk or, for example, an 8 mm storage tape. The input device **18** may alternatively include connections to other computer systems to receive the input commands and data therefrom.

The first processing unit **12** may include a visual interface for use in conjunction with the input device **18** and output device **20** similar to those screens illustrated in FIGS. **5–6**, discussed below. It is also understood that alternative devices may be used to receive commands and data from the user, such as keyboards, mouse devices, and graphical user interfaces (GUI) such as WINDOWS™ 3.1 available form MICROSOFT Corporation, Redmond, Wash., and other operating systems and GUIs, such as OS/2 and OS/2 WARP, available from IBM CORPORATION, Boca Raton, Fla. Processing unit **12** may also include microphones and/or telephone handsets for receiving audio voice data and commands, speech or voice recognition devices, dual tone multi-frequency (DTMF) based devices, and/or software known in the art to accept voice data and commands and to operate the first processing unit **12**.

In addition, either of the first processing unit **12** and the second processing unit **22** may be implemented in a personal digital assistant (PDA) providing modem and E-mail capabilities and Internet access, with the PDA providing the input/output screens for mouse interactions or for touch-screen activation as shown, for example, in FIGS. **5–6**, as a combination of the input device **18** and output device **20**.

For clarity of explanation, the illustrative embodiment of the disclosed point-to-point Internet protocol and system **10** is presented as having individual functional blocks, which may include functional blocks labeled as "processor" and "processing unit". The functions represented by these blocks may be provided through the use of either shared or dedicated hardware, including, but not limited to, hardware capable of executing software. For example, the functions of each of the processors and processing units presented herein may be provided by a shared processor or by a plurality of individual processors. Moreover, the use of the functional blocks with accompanying labels herein is not to be construed to refer exclusively to hardware capable of executing software. Illustrative embodiments may include digital signal processor (DSP) hardware, such as the AT&T DSP16 or DSP32 C, read-only memory (ROM) for storing software performing the operations discussed below, and random access memory (RAM) for storing DSP results. Very large scale integration (VLSI) hardware embodiments, as well as custom VLSI circuitry in combination with a general purpose DSP circuit, may also be provided. Any and all of these embodiments may be deemed to fall within the meaning of the labels for the functional blocks as used herein.

The processing units **12**, **22** are capable of placing calls and connecting to other processing units connected to the Internet **24**, for example, via dialup SLIP/PPP lines. In an exemplary embodiment, each processing unit assigns an unsigned long session number, for example, a 32-bit long sequence in a *.ini file for each call. Each call may be assigned a successive session number in sequence, which may be used by the respective processing unit to associate the call with one of the SLIP/PPP lines, to associate a <ConnectOK> response signal with a <Connect Request> signal, and to allow for multiplexing and demultiplexing of inbound and outbound conversations on conference lines, as explained hereinafter.

For callee (or called) processing units with fixed IP addresses, the caller (or calling) processing unit may open a "socket", i.e. a file handle or address indicating where data is to be sent, and transmit a <Call> command to establish communication with the callee utilizing, for example, datagram services such as Internet Standard network layering as well as transport layering, which may include a Transport Control Protocol (TCP) or a User Datagram Protocol (UDP) on top of the IP. Typically, a processing unit having a fixed IP address may maintain at least one open socket and a called processing unit waits for a <Call> command to assign the open socket to the incoming signal. If all lines are in use, the callee processing unit sends a BUSY signal or message to the caller processing unit. As shown in FIG. **1**, the disclosed point-to-point Internet protocol and system **10** operate when a callee processing unit does not have a fixed or predetermined IP address. In the exemplary embodiment and without loss of generality, the first processing unit **12** is the caller processing unit and the second processing unit **22** is the callee processing unit. When either of processing units **12**, **22** logs on to the Internet via a dial-up connection, the respective unit is provided a dynamically allocated IP address by an Internet service provider.

Upon the first user initiating the point-to-point Internet protocol when the first user is logged on to the Internet **24**,

the first processing unit **12** automatically transmits its associated E-mail address and its dynamically allocated IP address to the connection server **26**. The connection server **26** then stores these addresses in the database **34** and time stamps the stored addresses using timer **32**. The first user operating the first processing unit **12** is thus established in the database **34** as an active on-line party available for communication using the disclosed point-to-point Internet protocol. Similarly, a second user operating the second processing unit **22**, upon connection to the Internet **24** through an Internet service provider, is processed by the connection server **26** to be established in the database **34** as an active on-line party.

The connection server **26** may use the time stamps to update the status of each processing unit; for example, after 2 hours, so that the on-line status information stored in the database **34** is relatively current. Other predetermined time periods, such as a default value of 24 hours, may be configured by a systems operator.

The first user with the first processing unit **12** initiates a call using, for example, a Send command and/or a command to speeddial an N^{TH} stored number, which may be labeled [SND] and [SPD] [N], respectively, by the input device **18** and/or the output device **20**, such as shown in FIGS. **5–6**. In response to either the Send or speeddial commands, the first processing unit **12** retrieves from memory **16** a stored E-mail address of the callee corresponding to the N^{TH} stored number. Alternatively, the first user may directly enter the E-mail address of the callee.

The first processing unit **12** then sends a query, including the E-mail address of the callee, to the connection server **26**. The connection server **26** then searches the database **34** to determine whether the callee is logged-in by finding any stored information corresponding to the callee's E-mail address indicating that the callee is active and on-line. If the callee is active and on-line, the connection server **26** then performs the primary point-to-point Internet protocol; i.e. the IP address of the callee is retrieved from the database **34** and sent to the first processing unit **12**. The first processing unit **12** may then directly establish the point-to-point Internet communications with the callee using the IP address of the callee.

If the callee is not on-line when the connection server **26** determines the callee's status, the connection server **26** sends an OFF-LINE signal or message to the first processing unit **12**. The first processing unit **12** may also display a message such as "Called Party Off-Line" to the first user.

When a user logs off or goes off-line from the Internet **24**, the connection server **26** updates the status of the user in the database **34**; for example, by removing the user's information, or by flagging the user as being off-line. The connection server **26** may be instructed to update the user's information in the database **34** by an off-line message, such as a data packet, sent automatically from the processing unit of the user prior to being disconnected from the connection server **26**. Accordingly, an off-line user is effectively disabled from making and/or receiving point-to-point Internet communications.

As shown in FIGS. **2–4**, the disclosed secondary point-to-point Internet protocol may be used as an alternative to the primary point-to-point Internet protocol described above, for example, if the connection server **26** is non-responsive, unreachable, inoperative, and/or unable to perform the primary point-to-point Internet protocol, as a non-responsive condition. Alternatively, the disclosed secondary point-to-point Internet protocol may be used independent of the primary point-to-point Internet protocol. In the disclosed secondary point-to-point Internet protocol, the first processing unit **12** sends a <ConnectReq> message via E-mail over the Internet **24** to the mail server **28**. The E-mail including the <ConnectReq> message may have, for example, the subject

[*wp#XXXXXXXX#nnn.nnn.nnn.#emailAddr]

where nnn.nnn.nnn.nnn. is the current (i.e. temporary or permanent) IP address of the first user, and XXXXXXXX is a session number, which may be unique and associated with the request of the first user to initiate point-to-point communication with the second user.

The following E-mail messages are transmitted to a remote users post office protocol server via simple mail transport protocol using MIME by the event manager, as explained hereinafter.

<ConnectRequest>
<CampRequest>
<VoiceMail>
<FileTransfer>
<E-mail>

The following E-mail messages are received from a local WebPhone users POP server via the POP protocol using MIME by the event manager, as explained hereinafter.

<Connect Request>
<Camp Request>
<Voice Mail>
<File Transfer>
<E-mail>
<Registration>

As described above, the first processing unit **12** may send the <ConnectReq> message in response to an unsuccessful attempt to perform the primary point-to-point Internet protocol. Alternatively, the first processing unit **12** may send the <ConnectReq> message in response to the first user initiating a SEND command or the like.

After the <ConnectRequest> message via E-mail is sent, the first processing unit **12** opens a socket and waits to detect a response from the second processing unit **22**. A timeout timer, such as timer **32**, may be set by the first processing unit **12**, in a manner known in the art, to wait for a predetermined duration to receive a <ConnectOK> signal. The processor **14** of the first processing unit **12** may cause the output device **20** to output a Ring signal to the user, such as an audible ringing sound, about every 3 seconds. For example, the processor **14** may output a *.wav file, which may be labeled RING.WAV, which is processed by the output device **20** to output an audible ringing sound.

Second processing unit **22** polls mail server **28** at an interval, for example, once a minute, to check for incoming E-mail. Generally, second processing unit **22** checks the messages stored on mail server **28** at regular intervals to wait for and detect incoming E-mail indicating a <CONNECT REQ> message from first processing unit **12**.

Typically, for sending E-mail to user's having associated processing units operatively connected to a host computer or server operating an Internet gateway, E-mail for a specific user may be sent over Internet **24** and directed to the permanent IP address of the mail server providing the target user's mail services. The E-mail is transported by a standard protocol, for example, SMTP, and stored into memory (not shown in FIG. **1**) associated with mail server **28**.

The E-mail may subsequently be retrieved by processing unit **22** on behalf of the user with another standard protocol, for example POP **3**. The actual IP address utilized by the

user's processing unit is immaterial to the retrieval of E-mail, as the mail server **28** can, for example, be polled or queried from any point on the network.

Upon receiving the incoming E-mail signal from the first processing unit **12**, the second processing unit **22** may assign or may be assigned a temporary IP address. Therefore, the delivery of the E-mail through the Internet **24** provides the second processing unit **22** with a session number as well as IP addresses of both the first processing unit **12** and the second processing unit **22**.

Point-to-point communication may then be established by the processing unit **22** processing the E-mail signal to extract the <ConnectRequest> message, including the IP address of the first processing unit **12** and the session number. The second processing unit **22** may then open a socket and generate a <ConnectOK> response signal, which includes the temporary IP address of the second processing unit **22** as well as the session number of the first processing unit.

The second processing unit **22** sends the <ConnectOK> signal directly over the Internet **24** to the IP address of the first processing unit **12** without processing by the mail server **28**, and a timeout timer of the second processing unit **22** may be set to wait and detect a <Call> signal expected from the first processing unit **12**.

Real-time point-to-point communication of audio signals over the Internet **24**, as well as video and voicemail, may thus be established and supported without requiring permanent IP addresses to be assigned to either of the users or processing units **12**, **22**. For the duration of the realtime point-to-point link, the relative permanence of the current IP addresses of the processing units **12, 22** is sufficient, whether the current IP addresses were permanent (i.e. predetermined or preassigned) or temporary (i.e. assigned upon initiation of the point-to-point communication).

In the exemplary embodiment, a first user operating the first processing unit **12** is not required to be notified by the first processing unit **12** that an E-mail is being generated and sent to establish the point-to-point link with the second user at the second processing unit **22**. Similarly, the second user is not required to be notified by the second processing unit **22** that an E-mail has been received and/or a temporary IP address is associated with the second processing unit **22**. The processing units **12, 22** may perform the disclosed point-to-point Internet protocol automatically upon initiation of the point-to-point communication command by the first user without displaying the E-mail interactions to either user. Accordingly, the disclosed point-to-point Internet protocol may be transparent to the users. Alternatively, either of the first and second users may receive, for example, a brief message of "CONNECTION IN PROGRESS" or the like on a display of the respective output device of the processing units **12**, **22**.

After the initiation of either the primary or the secondary point-to-point Internet protocols described above in conjunction with FIGS. **1–2**, the point-to-point communication link over the Internet **24** may be established as shown in FIGS. **3–4** in a manner known in the art. For example, referring to FIG. **3**, upon receiving the <ConnectOK> signal from the second processing unit **22**, the first processing unit **12** extracts the IP address of the second processing unit **22** and the session number, and the session number sent from the second processing unit **22** is then checked with the session number originally sent from the first processing unit **12** in the <ConnectReq> message as E-mail. If the session numbers sent and received by the processing unit **12** match, then the first processing unit **12** sends a <Call> signal directly over the Internet **24** to the second processing unit **22**; i.e. using the IP address of the second processing unit **22** provided to the first processing unit **12** in the <ConnectOK> signal.

Upon receiving the <Call> signal, the second processing unit **22** may then begin a ring sequence, for example, by indicating or annunciating to the second user that an incoming call is being received. For example, the word "CALL" may be displayed on the output device of the second processing unit **22**. The second user may then activate the second processing unit **22** to receive the incoming call.

Referring to FIG. **4**, after the second processing unit **22** receives the incoming call, realtime audio and/or video conversations may be conducted in a manner known in the art between the first and second users through the Internet **24**, for example, by compressed digital audio signals. Each of the processing units **12, 22** also display to each respective user the words "IN USE" to indicate that the point-to-point communication link is established and audio or video signals are being transmitted.

In addition, either user may terminate the point-to-point communication link by, for example, activating a termination command, such as by activating an [END] button or icon on a respective processing unit, causing the respective processing unit to send an <End> signal which causes both processing units to terminate the respective sockets, as well as to perform other cleanup commands and functions known in the art.

FIGS. **5–6** illustrate examples of display screens **36** which may be output by a respective output device of each processing unit **12, 22** of FIGS. **1–4** for providing the disclosed point-to-point Internet protocol and system **10**. Such display screens may be displayed on a display of a personal computer (PC) or a PDA in a manner known in the art.

As shown in FIG. **5**, a first display screen **36** includes a status area **38** for indicating, for example, a called user by name and/or by IP address or telephone number; a current function such as C2; a current time; a current operating status such as "IN USE", and other control icons such as a down arrow icon **40** for scrolling down a list of parties on a current conference line. The operating status may include such annunciators as "IN USE," "IDLE," "BUSY," "NO ANSWER," "OFFLINE," "CALL," "DIALING," "MESSAGES," and "SPEEDDIAL."

Other areas of the display screen **36** may include activation areas or icons for actuating commands or entering data. For example, the display screen **36** may include a set of icons **42** arranged in columns and rows including digits **0–9** and commands such as END, SND, HLD, etc. For example, the END and SND commands may be initiated as described above, and the HLD icon **44** may be actuated to place a current line on hold. Such icons may also be configured to substantially simulate a telephone handset or a cellular telephone interface to facilitate ease of use, as well as to simulate function keys of a keyboard. For example, icons labeled L1–L4 may be mapped to function keys F1–F4 on standard PC keyboards, and icons C1–C3 may be mapped to perform as combinations of function keys, such as CTRL-F1, CTRL-F2, and CTRL-F3, respectively. In addition, the icons labeled L1–L4 and C1–C3 may include circular regions which may simulate lamps or light emitting diodes (LEDs) which indicate that the function or element represented by the respective icon is active or being performed.

Icons L1–L4 may represent each of 4 lines available to the caller, and icons C1–C3 may represent conference calls using at least one line to connect, for example, two or more parties in a conference call. The icons L1–L4 and C1–C3 may indicate the activity of each respective line or confer-

ence line. For example, as illustrated in FIG. **5**, icons L1–L2 may have lightly shaded or colored circles, such as a green circle, indicating that each of lines 1 and 2 are in use, while icons L3–L4 may have darkly shaded or color circles, such as a red or black circle, indicating that each of lines 3 and 4 are not in use. Similarly, the lightly shaded circle of the icon labeled C2 indicates that the function corresponding to C2 is active, as additionally indicated in the status are **38**, while darkly shaded circles of icons labeled C1 and C3 indicate that such corresponding functions are not active.

The icons **42** are used in conjunction with the status area **38**. For example, using a mouse for input, a line that is in use, as indicated by the lightly colored circle of the icon, may be activated to indicate a party's name by clicking a right mouse button for 5 seconds until another mouse click is actuated or the [ESC] key or icon is actuated. Thus, the user may switch between multiple calls in progress on respective lines.

Using the icons as well as an input device such as a mouse, a user may enter the name or alias or IP address, if known, of a party to be called by either manually entering the name, by using the speeddial feature, or by double clicking on an entry in a directory stored in the memory, such as the memory **16** of the first processing unit **12**, where the directory entries may be scrolled using the status area **38** and the down arrow icon **40**.

Once a called party is listed in the status area **38** as being active on a line, the user may transfer the called party to another line or a conference line by clicking and dragging the status area **38**, which is represented by a reduced icon **46**. Dragging the reduced icon **46** to any one of line icons L1–L4 transfers the called party in use to the selected line, and dragging the reduced icon **46** to any one of conference line icons C1–C3 adds the called party to the selected conference call.

Other features may be supported, such as icons **48–52**, where icon **48** corresponds to, for example, an ALT-X command to exit the communication facility of a processing unit, and icon **50** corresponds to, for example, an ALT-M command to minimize or maximize the display screen **36** by the output device of the processing unit. Icon **52** corresponds to an OPEN command, which may, for example, correspond to pressing the O key on a keyboard, to expand or contract the display screen **36** to represent the opening and closing of a cellular telephone. An "opened" configuration is shown in FIG. **5**, and a "closed" configuration is shown in FIG. **6**. In the "opened" configuration, additional features such as output volume (VOL) controls, input microphone (MIC) controls, waveform (WAV) sound controls, etc.

The use of display screens such as those shown in FIGS. **5–6** provided flexibility in implementing various features available to the user. It is to be understood that additional features such as those known in the art may be supported by the processing units **12**, **22**.

Alternatively, it is to be understood that one skilled in the art may implement the processing units **12**, **22** to have the features of the display screens in FIGS. **5–6** in hardware; i.e. a wired telephone or wireless cellular telephone may include various keys, LEDs, liquid crystal displays (LCDs), and touchscreen actuators corresponding to the icons and features shown in FIGS. **5–6**. In addition, a PC may have the keys of a keyboard and mouse mapped to the icons and features shown in FIGS. **5–6**.

Referring to FIG. **7**, the disclosed point-to-point Internet protocol and system **10** is illustrated. First processing unit **12** initiates the point-to-point Internet protocol in step **56** by sending a query from the first processing unit **12** to the connection server **26**. If connection server **26** is operative to perform the point-to-point Internet protocol, in step **58**, first processing unit **12** receives an on-line status signal from the connection server **26**, such signal may include the IP address of the callee or a "Callee Off-Line" message. Next, first processing unit **12** performs the primary point-to-point Internet protocol in step **60**, which may include receiving, at the first processing unit **12**, the IP address of the callee if the callee is active and on-line. Alternatively, processing unit **60** may initiate and perform the secondary point-to-point Internet protocol in step **62**, if connection server **26** is not operable.

Referring to FIG. **8**, in conjunction with FIGS. **1** and **3–4**, the disclosed point-to-point Internet protocol and system **10** are illustrated. Connection server **26** starts the primary point-to-point Internet protocol, in step **64**, and timestamps and stores E-mail and IP addresses of logged-in users and processing units in the database **34** in step **66**. Connection server **26** receives a query from a first processing unit **12** in step **68** to determine whether a second user or second processing unit **22** is logged-in to the Internet **24**, with the second user being specified, for example, by an E-mail address. Connection server **26** retrieves the IP address of the specified user from the database **34** in step **70**, if the specified user is logged-in to the Internet, and sends the retrieved IP address to the first processing unit **12** in step **72** to enable first processing unit **12** to establish point-to-point communications with the specified second user.

The disclosed secondary point-to-point Internet protocol operates as shown in FIG. **9**. First processing unit **12** generates an E-mail signal, including a session number and a first IP address corresponding to a first processing unit in step **76**. First processing unit **12** transmits the E-mail signal as a <ConnectRequest> signal to the Internet **24** in step **78**. The E-mail signal is delivered through the Internet **24** using a mail server **28** to the second processing unit **22** in step **80**. Second processing unit **22** extracts the session number and the first IP address from the E-mail signal in step **82** and transmits or sends the session number and a second IP address corresponding to the second processing unit **22**, back to the first processing unit **12** through the Internet **24**, in step **84**. First processing unit **12** verifies the session number received from the second processing unit **22** in step **86**, and establishes a point-to-point Internet communication link between the first processing unit **12** and second processing unit **22** using the first and second IP addresses in step **88**.

The primary and secondary point-to-point Internet protocols previously described enable users to establish real-time direct communication links over the Internet or other computer networks without the need for any interaction with connection server **26**, the connection server providing only directory and information related services.

FIG. **10** illustrates an exemplary computer network **1000** over which the invention may operate. A first processing unit **1012** is coupled to a computer network, illustrated here as the Internet **1010**, through an Internet service provider **1014**. Similarly, a second processing unit **1022** is coupled to Internet **1010** through Internet service provider **1018**. The inventive directory server **1020** is similarly coupled to Internet **1010** through Internet service provider **1026**. Directory server **1020** further comprises a connection server **1022** and information server **1024**, as will be explained hereinafter. The first processing unit **1012**, second processing unit **1022** and directory server **1020** are operatively coupled to each other via the Internet **1010**. It will be obvious to those reasonably skilled in the art that network **1000** is not

restricted to implementation over the Internet **1010** but may comprise other network configurations such as a local area network (LAN), a wide area network (WAN), a global area network or any number of private networks currently referred to as an Intranet. Such networks may be implemented with any number of hardware and software components, transmission media and network protocols.

Exemplary Computer Architecture

FIG. **11** illustrates the system architecture for a computer system **1100** such as an IBM PS/2®, suitable for implementing first and second processing units **1012** and **1022**, respectively, of FIG. **10**, as well as global server **1020**. The exemplary computer system of FIG. **11** is for descriptive purposes only. Although the description may refer to terms commonly used in describing particular computer systems, such as in IBM PS/2 computer, the description and concepts equally apply to other computer systems ranging from personal digital assistants (PDAs) to workstations to mainframe systems.

Computer system **1100** includes a central processing unit (CPU) **1105**, which may be implemented with a conventional microprocessor. System **1100** further includes a random access memory (RAM) **1110** for temporary storage of information, and a read only memory (ROM) **1115** for permanent storage of information. A memory controller **1120** is provided for controlling RAM **1110**. A bus **1130** interconnects the components of computer system **1100**. A bus controller **1125** is provided for controlling bus **1130**. An interrupt controller **1135** is used for receiving and processing various interrupt signals from the system components.

Mass storage may be provided by diskette **1142**, CD ROM **1147**, or hard drive **1152**. Data and software may be exchanged with computer system **1100** via removable media such as diskette **1142** and CD ROM **1147**. Diskette **1142** is insertable into diskette drive **1141** which is, in turn, connected to bus **1130** by a controller **1140**. Similarly, CD ROM **1147** is insertable into CD ROM drive **1146** which is, in turn, connected to bus **1130** by controller **1145**. Hard disk **1152** is part of a fixed disk drive **1151** which is connected to bus **1130** by controller **1150**.

User input to computer system **100** may be provided by a number of devices. For example, a keyboard **1156** and mouse **1157** are connected to bus **1130** by controller **1155**. An audio transducer **1196**, which may act as both a microphone and a speaker, is connected to bus **1130** by audio controller **1197**, as illustrated. It will be obvious to those reasonably skilled in the art that other input devices, such as a pen and/or tablet may be connected to bus **1130** with an appropriate controller and software, as required. DMA controller **1160** is provided for performing direct memory access to RAM **1110**. A visual display is generated by video controller **1165** which controls video display **1170**. Computer system **1100** also includes a communications adaptor **1190** which allows the system to be interconnected to a network such as a local area network (LAN), a wide area network (WAN), or the Internet, schematically illustrated by transmission medium **1191** and network **1195**.

In the illustrative embodiment, computer system **1100** may include an Intel microprocessor such as the 80486DX-33 MHz, or faster, a 14.4 Kb communication modem or faster, and a sound card, as further described with reference to FIG. **12**.

Operation of computer system **1100** is generally controlled and coordinated by operating system software, such as the OS/2® operating system, available from International Business Machines Corporation, Boca Raton, Fla., or Windows® DOS-based operating system available from Microsoft Corp., Redmond, Wash. The operating system controls allocation of system resources and performs tasks such as process scheduling, memory management, networking, and I/O services, among other things.

FIG. **12** illustrates schematically an audio sound card **1200** which may be used to implement audio controller **1197** of FIG. **11**. Specifically, sound card **1200** may comprise, in the exemplary embodiment, an analog-to-digital (A/D) converter **1212**, an input buffer **1216**, a digital signal processor (DSP) **1222**, ROM **1224**, RAM **1226**, an output buffer **1220**, and an analog-to-digital (D/A) converter **1218**, all of which may be interconnected over a bus **1210**. Bus **1210** is in turn coupled to a bus interface **1228** which, in turn, is coupled to bus controller **1125** of computer system **1100** of FIG. **11**.

As illustrated in FIG. **12**, A/D converter **1212** is coupled to audio transducer **1214** which is typically a microphone. Conversely, D/A converter **1218** is coupled to audio transducer **1230**, typically a speaker. It will be obvious to those reasonably skilled in the art that audio transducers **1214** and **1230**, may be combined into a single element which serves as both a transmitter and receiver of audio signal.

In operation, A/D converter **1212** samples the audio signals supplied to it by transducer **1214** and stores the digital samples in buffer **1216**. The digital sampling occurs under control of a program typically stored in ROM **1224**, or, alternatively, under the control of digital signal processor **1222**. The digital samples stored in input buffer **1216** are forwarded periodically, typically when the buffer reaches near capacity, over bus **1210** to bus **1130** of FIG. **11**, for further processing by computer system **1100**. The device driver for audio sound card **1200** generates system interrupts which will cause the digital samples stored in input buffer **1216** to be retrieved for processing. In the exemplary embodiment, the digital samples are uncompressed as supplied to computer system **1100**. However, compression of the digital samples may occur using DSP **1222** executing an appropriate compression algorithm, if desired.

Digital audio samples from computer system **1100** are also be converted to analog signals by sound card **1200**. The digital samples are supplied to bus **1210** and temporarily stored into output buffer **1220**. The digital samples are then converted by D/A converter **1218** into an analog signals which are then supplied to audio transducer **1230**, i.e., a speaker, or to further amplification and processing devices.

Sound card **1200** contemplated for use with the present invention may be implemented with any number of Windows compliant sound cards, such as the Sound Blaster sound card, commercially available from Creative Technologies Ltd., Singapore. Such Window compliant sound cards have a Windows compliant software interface allowing a standardized mechanism for software programs to operate the sound card device, such as Winsock 1.1.

WebPhone Application

In the exemplary embodiment of the present invention, each of first processing unit **1012** and second processing unit **1022** of FIG. **10** are executing a software application capable of enabling point-to-point communication over network **1000**, such as an Internet telephone application. One such application suitable for use with the present invention is the WebPhone Version 1.0 or higher, software, hereafter referred as the "WebPhone," commercially available from NetSpeak Corporation, Boca Raton, Fla. A description of the architecture and operation of the WebPhone is provided herein with reference to FIGS. **5–6**, **13**A–B and **14**. An extensive detailed description of the architecture, application program interface, graphic user interface, and operation of the WebPhone can be found in copending U.S. patent application

Ser. No. 08/719,554, XXX entitled "Point-to-Point Computer Network Communication Utility Utilizing Dynamically Assigned Internet Protocol Addresses" by Mattaway et al. filed on an even date herewith and commonly assigned, the complete subject matter of which is incorporated herein by reference.

Referring to FIGS. **13A–B**, schematic block diagrams of the WebPhone architecture are illustrated. The WebPhone is an end-user software application which enables users to send real-time audio data to other WebPhone users over the Internet or any public or private TCP/IP based computer networks. The WebPhone application and architecture may be designed to run on any number of operating systems or computer architectures. In the illustrative embodiment, the WebPhone application is implemented as a Windows compatible application executable on an IBM PC architecture or a clone thereof.

Referring to FIG. **13A**, the WebPhone **1300** comprises a set of object modules, written in a programming language such as C++, which work together in a concerted fashion to provide real-time, multitasking, network-based media transmission and reception. WebPhone **1300** comprises a graphic user interface (GUI) **1310**, a user interface (UI) **1312**, an event manager **1314**, a media engine **1316**, a database dynamic link library **1318**, one or more audio compression/decompression (codecs) **1320**, an audio manager **1324**, a WebPhone application program interface (API) **1326**, and a network interface **1322**.

WebPhone GUI **1310** comprises the visual objects seen on a computer display by the user, as illustrated by the screen capture of FIG. **14** discussed hereinafter. WebPhone GUI **1310** serves only to display the artwork associated with the underlying objects of WebPhone UI **1312**. WebPhone GUI **1310** may be implemented in a modular fashion distinct from the WebPhone UI for rapid portability. In this manner, other graphic user interface environments such as those compatible with the Macintosh, X-Windows or OS/2 operating systems, may be substituted via the Plug and Play protocol, as would be understood by those reasonably skilled in the arts.

The WebPhone UI **1312** objects maintain the state of the WebPhone GUI and provide feedback to the WebPhone GUI objects from events originating from either the user or the event manager **1314**. When WebPhone changes a state that requires user notification, WebPhone UI objects notify associated WebPhone GUI objects to display the appropriate art work to the user. WebPhone UI objects also interface with the database dynamic link library **1318** to maintain the WebPhone database information, e.g. configuration information, phone directory information, etc.

The WebPhone event manager **1314** processes all the events originating from the user, via WebPhone UI **1312**, the media engine **1316**, and WebPhone API **1326**. Event manager **1314** may be implemented as a table-driven state machine that processes the above-identified events and performs the functions necessary to bring the WebPhone from one state to another. For example, event manager **1314** interacts with media engine **1316** to create, control and remove concurrently executing jobs managed by media engine **1316**. Event manager **1314** also interfaces with the WebPhone API **1326** to provide communications with other WebPhones and connection servers, as described in more detail hereinafter. WebPhone database **1318** is a dynamic link library of tree-based subroutines that provide fast database access to the WebPhone configuration information, personal phone directory, etc.

WebPhone media engine **1316** manages the allocation of associated resources to provide a multitasking environment and controls the flow of real-time data streams, e.g., conversations, outgoing messages, etc., and non-real-time data streams, e.g., voice mail, graphic images, files, etc., to and from a user network connection. The objects representing tasks are created by event manager **1314**, thereby freeing media engine **1316** to manage resource routing. Specifically, the media engine routes data streams from sources such as a microphone, file or network socket, to destinations such as speaker, destination file or other network socket. To perform such routing functions the media engine interfaces with the WebPhone API **1326** to control communication with other processes, and further communicates with audio manager **1324** to communicate with the system input/output apparatus, such as sound card **1200** of FIG. **12**. Media engine **1314** may be designed to employ heuristic methods to sense and efficiently utilize available bandwidth to achieve timely and accurate delivery of all data streams, both real-time and non-real-time.

Media engine **1316** further interacts with WebPhone codec **1320** to achieve compression and decompression of audio data streams. Codec **1320** provides coding of digital samples from the sound card **1200** of FIG. **12** into a compressed format more suitable for transmission over a computer network. Codec **1320** further provides decoding of a compressed signal prior to its submission to sound card **1200** for subsequent conversion to an audible analog signal. In the exemplary embodiment, WebPhone codec **1320** is implemented in a modular fashion so that codecs may be replaced and updated with newer, more efficient compression/decompression algorithms via the Plug and Play protocol. A codec suitable for use with the present invention is the True Speech codec, version 8.5, commercially available from the DSP Group, Inc., Santa Clara, Calif. The True Speech codec is an enhanced linear predicative coding algorithm, specifically designed to efficiently encode and decode human speech data. The True Speech codec samples the digital sample stream from sound card **1200**, and, using a look-up table-based algorithm, tries to predict the value of the next data sample in the digital data stream based on the history of prior data sample values. The compressed data stream comprises a combination of identifiers of the predicted sample values, as well as error values used to correct the predictive values. Accordingly, the amount of digital data actually transmitted to represent the audio signal is significantly reduced in comparison to transmission of the actual data samples generated by sound card **1200**. The True Speech codec provides temporal, frequency domain compression of the digital data representing the audio signal.

Audio manager **1324** handles communication with the audio sound card **1200** and presents a common interface to media engine **1314**. Audio manager **1324** interfaces with sound card **1200** through one or more application program interfaces. In the illustrative embodiment, audio manager **1324** utilizes low-level Microsoft Windows wave input/output routines to interface with MCI compliant sound cards. As with codecs **1320**, audio manager **1324** may be implemented to adhere to the Plug and Play protocol so other compliant audio sound cards or circuits, such as those for the Apple Macintosh, commercially available from Apple Computer Company, Cupertino, Calif., or a Unix compatible sound card or circuit may interact with the audio manager **1324**.

The WebPhone API **1326** enables the WebPhone to communicate with other WebPhones, connection and directory assistance servers, Internet gateway servers, credit processing servers, database access servers and other client pro-

cesses implementing the WebPhone API. As illustrated in FIG. **13**B, the WebPhone API utilizes sockets, i.e., a file handle or address indicating where data is to be sent, allowing WebPhone API enabled processes to reside on the same computer, on a local area network, on a wide area network, or over the Internet. A process **1328** communicates with the WebPhone API **1326** through a plurality of sockets **1322**. The sockets **1322** are accessible by network **1330** through a number of protocols including Internet Protocol (IP) **1332**, Transmission Control Protocol (TCP) **1334**, Real-Time Protocol (RTP) **1336** and User Datagram Protocol (UDP) **1338**. The WebPhone API provides remote command control of WebPhones and servers via the TCP. WebPhone API **1326** transfers real-time and streamed audio via the UDP protocol and real-time audio and video data via the UDP and RTP protocols. The WebPhone API utilizes TCP to transfer data of different types, i.e., file, image, graphics, etc. as well as to transfer streamline video and other multimedia data types, such as Java developed by Sun MicroSystems, Mountain View, Calif. In addition, the WebPhone API provides user definable commands and data types.

FIG. **14** illustrates the graphic display produced upon invoking the WebPhone application. Display **1400** is an alternative embodiment to that illustrated in FIGS. **5–6** with similar graphic elements, icons and display areas functioning as previously described with reference to FIGS. **5–6**.

WebPhone Global Server

Having described the architecture of the WebPhone software which enables the first and second processing units to establish point-to-point communication over a network, a discussion of the global connection/information server is appropriate.

Referring to FIG. **15**A, a network diagram, similar to that shown in FIG. **10**, is illustrated, including a schematic diagram of the global server **1500** and the various devices operatively coupling server **1500** to the Internet **1530**. A first processing unit executing the WebPhone application, hereafter referred to as WebPhone **1536**, is coupled to Internet **1530** through an Internet service provider **1532**. Similarly, a second processing unit executing the WebPhone application, referred to as WebPhone **1538**, is coupled to the Internet **1530** by an Internet service provider **1534**. Global server **1500** is coupled to Internet **1530** by an Internet service provider **1528**, a CSU/DSU **1526**, a router **1524**, and a fire wall server **1522**. In the illustrative embodiment, fire wall server **1522** and global server **1500** are connected through a local area network **1520**. Network **1520** may be implemented with an Ethernet or other suitable transport for TCP/IP communications. However, as will be obvious to those recently skilled in the arts, server **1500** may be connected directly to fire wall server **1522**.

In the illustrative embodiment, firewall server **1522** is a single firewall mechanism which protects unauthorized access from network **1530** into global server **1500**. Firewall server **1522** may be implemented on a work station, such as a SPARC 5 or SPARC 20 server from Sun MicroSystems, executing a commercially available firewall software application such as Raptor, available from Raptor Systems. Essentially, the firewall server prevents unauthorized access into global server **1500** and thereby prevents destruction of any of the information contained therein by checking the source of requests for information to global server **1500**.

Router **1524** translates logical addresses among networked topologies and may be implemented with any number of commercial router devices such as the CISCO model 2501 router executing CISCO 11.0 software, both commercially available from CISCO Systems, Inc., San Jose, Calif.

CSU/DSU **1526** (Channel Send Unit/Data Send Unit) functions as a sophisticated modem, converting network data to high speed serial data for transfer over a T1 or T3 line. Such high speed data is connected to another CSU/DSU, typically at the telephone company over the T1 or T3 line. An apparatus suitable for use in implementing CSU/DSU **1526** in the present invention is the AT&T Paradigm by AT&T Laboratories, Murray Hill, N.J.

FIG. **15**A further illustrates a logical schematic of global server **1500**. The server comprises a hardware platform **1508** on which an operating system **1510** executes. In the illustrative embodiment, hardware platform **1508** may comprise any number of commercially available high end work stations such as a DEC Alpha 4100 System, commercially available from Digital Equipment Corporation, Maynard, Mass., or a SPARC 5 or a SPARC 20, both commercially available from Sun Micro Systems, Mountain View, Calif. Operating system **1510**, in the illustrative embodiment, may comprise the Unix, commercially available from Novell, Windows NT, commercially available from Microsoft Corporation, or Solaris, commercially available from Sun MicroSystems, Inc. Executing on operating system **1510** are a number of processes including connection server **1512**, information server **1514**, database server **1518** and database **1516**.

Connection Server

Connection server **1512** provides a directory information service to WebPhone client processes currently on-line with respect to the computer network. Connection server **1512** behaves like a virtual machine within global server **1500** and interacts with database **1516** through database server **1518** and with network interface card **1540** through the WebPhone API. The basic function of connection server **1512** is to provide a one-to-one mapping between an identifier of a WebPhone client process, such as a E-mail address, and the current IP address, dynamic or fixed, associated with that WebPhone client process.

As described in further detail hereinafter, when a WebPhone client transmits a <CONNECT REQ> packet to global server **1500**, an E-mail address such as "Shane@netspeak.com" is provided to connection server **1512**. Connection server **1512** then compares the E-mail address with the values of the records contained in on-line table **1516**B and, if a match occurs with one of the records contained therein, transmits the value of the Internet Protocol address associated with that record to the requesting WebPhone client, i.e., a one-to-one matching between E-mail addresses and Internet Protocol addresses.

Referring to FIG. **16**A, a flow chart illustrating the basic process steps used by connection server **1512** to implement a one-to-one mapping of E-mail addresses to Internet Protocol addresses in accordance with the present invention is illustrated. The coding of the process steps of the flowchart of FIG. **16**A into instructions suitable to control global server **1500** will be understandable by those having ordinary skill in the art of programming. Connection server **1512** remains in an idle state until a <CONNECT REQ> packet is transmitted from a WebPhone client to global server **1500**, as illustrated by decisional block **1610** of FIG. **16**A. Upon receipt of the packet, connection server **1512** extracts the E-mail address from the packet and supplies the E-mail address to database server **1518** which them communicates using the ODBC standard with database **1516** to perform a search of On-line Table **1516**B, as illustrated by process blocks **1612** and **1614**. Database **1516** performs a search of on-line Table **1516**B and supplies the current Internet Protocol address of the WebPhone client associated with the

E-mail address to connection server **1512**, via database server **1518**. If a corresponding Internet Protocol address is found for the E-mail address contained in the query, connection server **1512** supplies the Internet protocol address to the requesting WebPhone client by transmitting a <CONNECT ACK> packet, as illustrated by decisional block **1616** and process block **1618**. If, however, there is no Internet Protocol address associated with the queried E-mail address or the WebPhone client is off line, connection server **1512** will send an <OFFLINE> packet to the WebPhone client, as illustrated by process block **1622**. Connection server **1512** will return to an idle state to await the receipt of another <CONNECT REQ> packet, as illustrated by FIG. **16**A. A description of the above described packets as well as a diagram illustrating the packet transfer sequence between a WebPhone client and global server **1500** can be found with reference to Tables **7–8** and FIG. **17**A, respectively.

Information Server

Information server **1514** provides an interface between requests from WebPhone client processes and database **1516**. Information server **1514** includes code written to extract the search criteria from an <INFO REQ> packet and supply the search criteria to the database search engine of database **1516** using the ODBC standard. In particular, referring to FIG. **16**B, a flow chart illustrating the basic process steps used by information server **1514** in performing information/directory service functions in accordance with the present invention is illustrated. The coding of the process steps of the flow chart into instructions suitable for execution by global server **1500** will be understood by those having ordinary skill in the art of programming. Information server **1514** remains idle until an <INFO REQ> packet is received from a WebPhone client process, as illustrated by decisional step **1630**. Next, information server **1514** extracts the data elements defined within the <INFO REQ> packet and supplies them to database server **1518** which, in turn, forward them to database **1516**, as represented by the process step **1634** and **1636**. The search engine contained within database **1516** performs the search and supplies to information server **1514** all client records meeting the search criteria specified in the <INFO REQ> packet, or a message indicating that no records were found. Next, information server **1514** transmits a <INFO ACK> packet to the WebPhone client process indicating the number of records satisfying the search criteria, as indicated by process step **1638**. The WebPhone client may wish to receive all records satisfying the search criteria, or, if the number is excessively large, may desire to further refine the search by transmitting a <INFO ABORT> packet to information server **1514** and defining new search parameters to be sent with a subsequent <INFO REQ> packet. If a <INFO ABORT> packet is received by information server **1514**, the process will return to an idle state, as illustrated by decisional block **1640**. If no <INFO ABORT> packet was received, information server **1514** will transmit one or more <INFO> packets to the requesting WebPhone client until all records have been received by the WebPhone client, as illustrated by process step **1642**. Information server **1514** will return to an idle state awaiting another <INFO REQ> packet, as illustrated in FIG. **16**B. A description of the packets comprising the WebPhone protocol is illustrated in Tables 7–8 and a diagram illustrating the packet transfer sequence defined in FIG. **17**A–B.

Network interface card **1540** interfaces with connection server **1512**, information **1514**, and database server **1518** using the WebPhone API definition, as described herein, and the Windows Sockets 1.1 Protocol, or, in a Unix-based operating system, Berkeley Sockets Network API. Network interface card **1514** may comprise, in illustrative embodiment, an Ethernet card capable of transmitting data at rates of 100 Mbps or greater, such cards being commercially available through a number of different vendors.

The connection from CSU/DSU **1526** to ISP **1528** may comprise a T1 connection, i.e., a long-distance, digital, point-to-point communication circuit capable of transmitting a signal at 1.544 Mbps with 24 channels at 64 Kbps. Alternatively, a T3 connection may be used, i.e., a connection is similar to a T1 connection except it is capable of transmitting at 44.746 Mbps per second with up to 28 T1 channels. Other connections may be suitable, depending on specific requirements and availability.

Database

Database **1516** of global server **1500** may be implemented with any of a number of commercially available structured query language (SQL) database engines, such as Oracle 7.x, Informix, or Microsoft SQL server 6.x. The SQL database resides on a RAID **1** and RAID **5** mirrored disk array. As will be explained hereinafter, database **1516** interacts with control server **1512** and information server **1514** through database server **1518**. In the illustrative embodiment, database **1516** comprises a Client table **1516**A, an On-line table **1516**B, a WebBoard table **1516**C, a WebBoard configuration table **1516**D and a WebBoard Source table **1516**E.

Client table **1516**A comprises a plurality of records, each of which may have the fields and corresponding data elements as described in Table 1. Each WebPhone user, hereinafter "client," has a separate record in table **1516**A containing the information defining the client's profile of personal information. In Table 1, the "activated," "paid," and "published" fields are boolean yes/no fields. The "id" field comprises a unique ID sequence identifying a particular WebPhone client. The "activation date," "address change date," and "access date" fields are time references measured in seconds since 00:00 Coordinated Universal Time (UTC), Jan. 1, 1970. The "IPAddr" field represents the Internet protocol address of the WebPhone client and, if unknown, has a default value of 0.0.0.0. The database record containing a WebPhone client's profile, is defined upon first logging-on to global server **1500** and may be updated each time a WebPhone user's profile changes, as explained hereinafter.

The On-line table **1516**B provides a dynamic list of those clients from **1516**A who are currently On-line, as well as their current Internet protocol address. On-line Table **1516**B comprises a plurality of records each of which may have the fields and data types illustrated in Table 2. The record entries of On-line table **1516**B are used by connection server **1512** and information server **1514**, as explained hereinafter, to provide a directory of those WebPhone client processes currently having on-line status with respect to the computer network.

The WebBoard™ is a virtual multimedia billboard which is transmitted as a series of multimedia data files to WebPhone client processes while the WebPhone application is activated. An extensive description of the WebBoard utility and its operation can be found in copending U.S. patent application Ser. No. 08/719,891 entitled Method and Apparatus for Distribution of Multimedia Data Over a Computer Network by Mattaway et al., commonly assigned, the subject matter of which is incorporated herein by reference.

A number of tables are associated with the WebBoard functionality including WebBoard table **1516**C, a WebBoard configuration table **1516**D, and a WebBoard source table **1516**E. WebBoard table **1516**C includes a plurality of

records each describing a specific WebBoard and having the field and data types illustrated in Table 3. The "id" field of Table 3 provides a unique identification number for the WebBoard file. The "imageType" field defines the video format of the image such as JPEG, TIF, GIF, etc. The "audio" field defines the nature of the audio file, e.g. a .wav file or a MIDI file, while the "audioType" field defines the codec, if any, used to compress/decompress the audio file. The "hits" field defines the number of times the WebBoard has been selected by WebPhone clients, while the "hits profile" field defines the file name of the file identifying those WebPhone clients generating hits to the subject WebBoard.

The WebBoard configuration table **1516**D may have at least one record having the fields and data types illustrated in Table 4. The count field represents the number of WebBoard records currently in the table **1516**C.

The WebBoard source table **1516**E may comprise a plurality of records each having the fields and data types defined in Table 5. The "URL" field of Table 5 defines a data link in accordance with Uniform Resource Locator protocol to the home page or Web site of the source. In the illustrative embodiment, any entity, including vendors, advertisers, individuals or groups wishing to post information or having a Web site or home page may have a WebBoard displayable through the present invention.

Database Server

Database server **1518** serves as the interface between database **1516** and connection server **1512** and information server **1514**. Specifically, connection server **1512** and information server **1514** communicate with database engine **1518** through application program interfaces embedded in the code implementation of both the connection server and the information server. Database server **1518** communicates with database **1516**, in the illustrative embodiment, using the open database connectivity (ODBC) standard, developed by Microsoft Corporation, Redmond, Wash. Database server **1518** functions to supply structured database queries to database **1516** and to supply the results therefrom to connection server **1514** and information server **1512**. In the illustrative embodiment, database server **1518** may be implemented as a "virtual machine" executing on global server **1500**, or, alternatively, may be implemented on a separate computer system such as a DEC Alpha 4100 Workstation executing DEC Unix operating system, both available from Digital Equipment Corporation, Maynard, Mass. Database server **1518** communicates with network interface card **1518** using the WebPhone Application Program Interface described herein.

Global Server Network

In the illustrative embodiment, global server **1500** is implemented as a single server apparatus on which a plurality of "virtual machines" execute simultaneously. However, it will be obvious to those reasonably skilled in the art that a plurality of separate servers, one dedicated to each of connection server **1512**, information server **1514**, and database server **1518** may be interconnected to database **1516** and to each other using a local area network, to form a composite "virtual" global server, as illustrated by FIG. **15**B, the construction of the system illustrated in FIG. **15**B being within the knowledge of those reasonably skilled in the art in light of the descriptions contained herein.

It is further contemplated within the present invention that more than one global server **1500** may be utilized, as illustrated by FIG. **15**C. In this implementation, multiple global servers **1500**A–D are maintained for fault tolerant load sharing, each one performing the above-described connection server, information server and database server processes. Each of global servers **1500**A–D are connected to the Internet via a separate T1 or T3 connection to different Internet service providers, and are synchronized with each other via database server replication. In such an embodiment, multiple global servers may be located in close proximity or in geographically disparate locations. In such an embodiment, the WebPhone application is provided with the network address information of each global server **1500**A–D. In the event that any one of the global servers initially contacted is nonresponsive the WebPhone application will attempt connection to one or more of the remaining global servers to obtain directory and information services.

Further, in an implementation with multiple global servers, if the initially contacted global server is unable to accommodate a WebPhone client request, or, is not geographically convenient, the global server can provide the network address of another global server capable of servicing the WebPhone client's request or which is logically more convenient. This process may occur during the initial log-in of the WebPhone client process, as described with references to messages **1**–**5** of FIG. **17**A.

As previously described, if none of the global servers are available, the WebPhone application can rely on the secondary Internet Protocol technique in which a WebPhone client process sends its current dynamically assigned Internet Protocol address to a prospective WebPhone callee through an E-mail message, as described herein.

WebPhone Protocol

Prior to describing the interaction of the connection server **1512** and information server **1514** with WebPhone client processes, a description of the WebPhone protocol by which the WebPhone client processes and the global server **1500** communicate is appropriate. Tables 6–7 below illustrate the packet definitions of the packets comprising the WebPhone protocol (WPP) including the packet type, the direction and the data elements comprising each packet. In Tables 6–7 the symbol "→" indicates a packet transmitted by a WebPhone client process, while the "←" symbol indicates a packet transmitted by the global server. Tables 8–9 define the data elements described in Tables 6–7. In Tables 6–9, the terms "ULONG" and "UNSIGNED LONG" designate an unsigned long integer value, i.e., 32-bit integer value. Similarly, the terms "USHORT" and "UNSIGNED SHORT" designate an unsigned short integer value, i.e., 16-bit integer value. The term "CHAR" designates a single character, typically assuming a binary value of either 1 or 0. The term "VARCHAR(X)", where X is an integer, value symbolizes a variable length character string, with the number of characters indicated with the integer value. The term "UNSIGNED CHAR" designates an 8-bit character code, i.e., no sign bit. Finally, the term "variable" indicates a variable length data field.

FIG. **17**A illustrates a schematic block diagram of a packet transfer sequence between a pair of WebPhone client processes and the global server, in accordance with the present invention. Each WebPhone application, also referred to as a WebPhone client process, connects to global server **1500** upon start up to inform global server **1500** that the WebPhone client process is on-line and available to make and/or receive calls. Specifically, as illustrated in FIG. **17**A, WebPhone **1536** opens a socket to the global server **1500** and transmits an <ONLINE REQ> packet from WebPhone **1536** to Global server **1500**, as illustrated by message **1** and FIG. **17**A. The <ON LINE REQ> packet may have the format and data illustrated in Table 6, and additional Feature bits which define the functionality of the WebPhone

application, as explained in greater detail hereinafter. In response, connection server **1512** and information server **1514** of global server **1500** use the information contained in the <ONLINE REQ> packet to update the status of database **1516**. In the event that the WebPhone client process is logging on for the first time, global server **1500** returns to the WebPhone **1536** a <USER INFO REQ> packet, as illustrated by message **2** of FIG. **17**A. The <USER INFO REQ> packet includes the elements as defined in Table 9. In response, WebPhone **1536** returns a <USER INFO> packet as illustrated by message **3** of FIG. **17**A. The <USER INFO> packet contains the data elements defined in Table 8. Connection server **1512** and information server **1514** of global server **1500** utilize the data in the <USER INFO> packet to update database **1516**. Specifically, information server **1514** utilizes such data to create a record in client table **1516**A representing WebPhone **1536**. Next, global server **1500** transmits to WebPhone **1536** a <REGISTRATION> packet, as illustrated by message **4** of FIG. **17**A. The <REGISTRATION> packet contains the data described in Table 7 plus Feature bits, as described hereinafter. The <REGISTRATION> packet returned to WebPhone **1536** enables certain functions within the WebPhone architecture based on predetermined criteria, for example, whether the user has paid for the product, or which version of the product the user possesses. Following the <REGISTRATION> packet, global server **1500** further transmits an <ONLINE ACK> packet, as illustrated by message **5** of FIG. **17**A. Prior to transmission of the <ONLINE ACK> packet, connection server **1514** updates database **1516**, specifically On-line table **1516**B to indicate that WebPhone **1536** is on-line with respect to the computer network. Upon receiving the <ONLINE ACK> packet, WebPhone **1536** closes the socket to global server **1500**.

In the event WebPhone **1536** had previously registered with global server **1500**, only messages **1** and **5** are required to establish WebPhone **1536** as being on-line. If WebPhone **1536** had new user information to supply to global server **1500**, then packet sequence illustrated by messages **3** and **4** would occur.

Although the packet sequence illustrated by messages **1–5** is described with reference to WebPhone **1536**, WebPhone **1538** interacts in a similar manner with global server **1500** to establish on-line status. No further interaction occurs between the respective WebPhone client processes and the global server unless the WebPhones require directory or search assistance about a prospective callee.

In one calling scenario, a WebPhone user knows the E-mail address of another WebPhone user to which he/she wishes to establish a point-to-point communication, however, the current dynamically assigned Internet protocol address of the callee is unknown to the caller. In this scenario, the user of WebPhone **1536** requests assistance from global server **1500** to obtain the current dynamically assigned Internet Protocol address of the prospective callee WebPhone. First, the user of WebPhone **1536** specifies the callee by entering all or part of the callee party's name or alias in the party name field area of the graphic user interface. If the party is not in the WebPhone user's local directory, the IP address or E-mail address of the callee WebPhone may be entered into the number field area of the graphic user interface, followed by activation of the send button or icon on the graphic user interface. As a result, WebPhone **1536** opens a socket to global server **1500** and transmits a <CONNECT REQ> packet having the format described in Table 6. Connection server **1512** of global server **1500** utilizes the value of the E-mail address specified in the <CONNECT REQ> packet to perform a one-to-one mapping in the on-line table **1516**B to determine the current Internet Protocol address of the indicated callee, as illustrated by the flowchart of FIG. **15**A. Once this mapping is performed, the server **1500** transmits to WebPhone **1536** a <CONNECT ACK> packet, as indicated by message **7**A of FIG. **17**A. The <CONNECT ACK> packet has the format and content as illustrated in Table 6 and includes the IP address of the callee as well as information such as an error code to indicate that no WebPhone application is associated with that callee. Alternatively, if the selected callee is off line, global server **1500** transmits to WebPhone **1536** an <OFF LINE> packet to indicate that the desired party is not on-line, as illustrated by message **7**B of FIG. **17**A. Following the receipt of either a <CONNECT ACK> or an <OFF LINE> packet by WebPhone **1536**, the socket to global server **1500** opened by WebPhone **1536** is closed.

If the current Internet Protocol address of the callee was returned from global server **1500**, the packet transmission sequence illustrated between WebPhones **1536** and **1538** of FIG. **17**A transpires. Whether a calling WebPhone knows the Internet Protocol address of the callee WebPhone, as in the case of a fixed Internet Protocol address, or obtains the Internet Protocol address from global server **1500**, as previously described, the calling sequence to establish a call occurs as follows. WebPhone **1536** opens a socket to WebPhone **1538**. Next, WebPhone **1536** transmits to WebPhone **1538** a <CALL> packet as illustrated by message **8** of FIG. **16**A. The <CALL> packet has the format illustrated in Table 6 and may, optionally, include information identifying the compression/decompression (codec) used by the caller WebPhone. In response to the <CALL> packet, WebPhone **1538** may return with a number of different packets, as illustrated by messages **9**A–D. First, callee WebPhone **1538** may respond to caller WebPhone **1538** with a <REJECT> packet, as illustrated by message **9**A, indicating that the callee WebPhone does not wish to be disturbed, e.g. total call blocking, or, that the callee WebPhone does not wish to talk to caller WebPhone, e.g. party specific or group specific call blocking. In the event of party or group specific call blocking, the user information contained within the <CALL> packet of message **9**A is compared by the caller WebPhone application to a predefined list of WebPhone user information profiles which the callee does not wish to converse, such list having been predefined by the callee in the WebPhone user's personal directory, as explained hereinafter. Upon receiving the <REJECT> packet the caller WebPhone annunciates the result to the user and the socket to the callee WebPhone is closed.

Alternatively, callee WebPhone **1538** may return a <BUSY> packet, as illustrated by message **9**B of FIG. **17**A. The <BUSY> packet indicates that the callee WebPhone is currently utilizing all available lines within its WebPhone application.

A further possible response from callee WebPhone **1538** is to issue an <ANSWER MACH> packet, as illustrated by message **9**C of FIG. **17**A. The <ANSWER MACH> packet includes data indicating whether the machine is capable of receiving voice mail type messages, as described in greater detail in copending U.S. patent application Ser. No. 08/719,898 entitled "Method and Apparatus for Providing Caller Identification Based Out-Going Messages in a Computer Telephony Environment," by Mattaway et al., commonly assigned and incorporated herein by reference.

The preferred response by callee WebPhone **1538** is to transmit a call acknowledge <CALL ACK> packet, as illustrated by message **9**D of FIG. **17**A. The <CALL ACK>

packet has the data content illustrated in Table 6. Both the <CALL> and <CALL ACK> packets contain the information of the WebPhone users sending the packet. This information is useful by the recipient of the packet for a number of purposes. For example, the user information is displayed on the enunciator area of the WebPhone graphic display to identify the party placing the call. Second, the user may select such information and, using the drag and drop functionality of the WebPhone graphic user interface, add the user information to the callee WebPhone user's personal directory resident within his/her specific WebPhone application. In such a manner, both parties are completely identified to each other prior to commencing audio communications. The transmission of complete caller identification information with the <CALL> and <CALL ACK> symbols packets enables such functions as individual or group specific call blocking, party specific outgoing messages, visual caller identification, and party specific priority ringing and sound effects, as explained herein.

Following transmission of <CALL ACK> packet by callee WebPhone **1538**, the callee WebPhone further transmits an <ANSWER> packet to caller WebPhone **1536**, as illustrated by message **10** of FIG. **17**A. Like the <BUSY> packet, the <ANSWER> packet is essentially empty, containing nothing more than a session ID number which is unique to the call. The socket previously opened by caller WebPhone **1536** over which the forgoing packets were transmitted remains open for the transmission of control information between caller WebPhone **1536** and callee WebPhone **1538**. Such control information may comprise an <END> packet signaling the end of a call, a <HOLD> packet indicating that one of the parties to a call has placed the call "on hold" or other packets related to advance functionality of the WebPhone architecture. In addition, caller WebPhone **1536** opens a second socket to callee WebPhone **1538** over which the respective WebPhones may exchange <AUDIO> packets, as illustrated by messages **11**A–B of FIG. **17**A. The <AUDIO> packets have the data content illustrated in Table 6. The WebPhone application enables the parties to converse in real-time, telephone quality, encrypted audio communication over the Internet and other TCP/IP based networks. If both WebPhone client processes are utilized with full duplex sound cards, such as that illustrated in FIG. **12**, the WebPhone users may transmit and receive audio packets simultaneously, similar to normal telephone conversation. However, if the WebPhone client processes are used with half duplex sound cards, a WebPhone user may only transmit or receive audio data simultaneously, similar to a speaker phone. Exchange of <AUDIO> packets continues until either the callee WebPhone or the caller WebPhone transmits an <END> packet, as illustrated by message **12** of FIG. **16**A. Following the receipt of an end packet, the WebPhone client process will cease to accept subsequent audio packets.

Following either transmission or receipt of an <END> packet by the caller WebPhone, the socket opened by the caller WebPhone to the callee WebPhone over which real-time audio communication occurred is closed. Similarly, the previously opened socket over which control information was transmitted between the callee and caller WebPhones is likewise closed.

Referring now FIG. **17**B, if a WebPhone caller seeks to determine whether a prospective WebPhone callee is connected to the computer network, but, has little information regarding the client process, information server **1514** may be utilized as described. The WebPhone user defines One or more of the first name, last name, company, city, state, or country values of the Query field contained within the <INFO REQ> packet sends the packet to the global server. WebPhone **1536** opens a socket to global server **1500** and forwards <INFO REQ> packet to global server **1500**, as illustrated by message **1** of FIG. **17**B. Information server **1514** extracts the values specified the query field of the <INFO REQ> packet and queries the database **1516**, as previously described with reference to FIG. **16**B. Global server **1500** then transmits a <INFO ACK> packet back to WebPhone **1536**, as illustrated by message **2** of FIG. **17**B. The <INFO ACK> packet has the format and data elements indicated in Table 7, including the number of parties satisfying the search criteria, specified in the <INFO REQ> packet. If the user of WebPhone **1536** wishes to receive the number of parties satisfying the search criteria global server **1500** automatically transmits to WebPhone **1536** one or more <INFO> packets, as illustrated by messages **3**A–C of FIG. **17**B. The <INFO> packet has the format and data elements as described in Tables 6–7. At any time following transmission of the <INFO ACK> packet, WebPhone **1536** may transmit an <INFO ABORT> packet to either prevent transmission of any <INFO> packets or to stop transmission of any remaining packets, as illustrated by message **4** of FIG. **17**B. The <INFO ABORT> packet has the format and data elements as described in Table 6–7.

Once the user receives the information contained within the <INFO> packets satisfying the search criteria, the user may store such information in his/her personal WebPhone directory by dragging and dropping the information from the annunciator area to the direction dialog box using the WebPhone GUI.

The methods and apparatus described herein provide computer users with a powerful protocol in which to directly establish real-time, point-to-point communications over computer networks directly without server required linking. The a directory server assists in furnishing the current dynamically assigned internet protocol address of other similarly equipped computer users or information about such users.

WebPhone Graphic User Interface

Referring again to FIG. **14**, the WebPhone GUI **1400** consists of a main window which has the look of a modern cellular flip phone and a set of dialog boxes launched from window. Operation of the WebPhone is controlled by selecting objects, i.e., buttons, text and images, and dragging objects, i.e., lines, parties, messages, etc., as explained hereinafter.

WebPhone GUI **1400** comprises a plurality of visual objects, including display **1402**, number pad **1406**, line pad **1404**, call function buttons **1408**, phone function buttons **1410** and audio controls (not shown). Display **1402** provides a number of distinct area for presentation of entering of information useful in operation of the WebPhone application. A party name field **1402**A displays the name of the caller when an incoming call arrives and may also be used for entering the name of a party, up to 25 characters. By entering the name of a party in the party name field **1402**A and pressing one or more of the phone function buttons **1410**, various activities may be accommodated. For example, entering the name of a party in the party name field and pressing the [SND] button causes the WebPhone to first search the personal information directory for the information profile of the party entered. If such party's information is not already resident in the personal information directory, the WebPhone will open up a directory assistance dialog allowing the user to enter information to be submitted to the information server **1514** for searching, as described previously. Further, clicking the entered party name with the right

mouse button causes a dialog box to appear enabling the user to modify the current directory entry, if any, for the party entered.

Entering the IP address of a party in the party IP address field followed by the [SND] button causes initiation of a call. If the callee's name exists within the caller's personal directory, or the call is established, the callee's name will appear in a party name field for caller ID purposes.

The third line of the display **1402** serves as a status annunciator line for displaying iconic feedback about the status of events within the WebPhone. Such status icons may include icons indicating enablement of call forwarding, call blocking, do not disturb, priority ringing, file transfer occurring, voice mail transfer occurring or call camping.

The line number annunciator indicates the line, i.e., lines 1–4, currently active, as illustrated by annunciated field **1402**J. A main LED **1402**F indicates when a line is active by changing color. Time field **1402**C displays the local time when no lines are active. When one of the lines L1–L4 are active, time field **1402**C displays the callee party's time. By single clicking the time field the user can cycle through the two different time values.

The line status field **1402**H displays the status of the currently selected line, illustrated in FIG. **14** as displaying "talk" status. A call duration field **1402**D displays the elapsed time in minutes and seconds since the currently displayed call commenced.

The V-mail field **1402**G displays the number of the new voice mail messages and the total number of voice mail messages received.

When one or more call functions such as call conferencing, call blocking, priority ringing, call camping, or call forwarding are activated, the list of those parties within the WebPhone personal directory having such functionality active for their information profile can be viewed in the party name field by selecting a list arrow (not shown) icon which appears whenever one of the previously described functions is activated. Pressing the icon arrow allows the parties to be viewed sequentially.

The number pad buttons **0–9** also serve as speeddial buttons. Right clicking on any one of the number pad buttons **0–9** causes the name, alias, e-mail address and IP address, if known, of the party assigned to that speed dial position to be displayed on display **1402**.

If a user right clicks on any of lines L1–L4 the name, alias, e-mail address and IP address of the party on that line will similarly appear for a predetermined period of time and then revert back to the normal display.

The keypad buttons displayed on WebPhone GUI **1400** may assume one of two states. A button may be a momentary button which, when pressed, i.e., left clicked, gets pushed in and then pops back out again. A second type of button is a toggle button which when pressed gets pushed in and stays in until pressed again. Number pad buttons **0–9** are momentary buttons which may be used to enter the Internet Protocol address of a party and which each house a speed-dial position. The user may assign a party to one of the ten speed-dial positions by selecting the user's information displayed in display **1402** and then dragging it onto the keypad button. To speed-dial one of the ten buttons the user simply presses the appropriate number followed by the [SND] button. As stated previously, if the user right clicks on one of the number pad buttons, the information about the party assigned to the speed-dial position will be displayed.

The line pad **1404** comprises four toggle buttons L1–L4, each of which has a letter, a number and an LED indicating the status of the line. When one or more parties are associated, i.e., dragged and dropped, with a line, the letter designating the appropriate line turns from an L to C indicating a conference call. When only one party is left on the line the letter designation reverts from a C back to an L indicating a regular call. Only one line, button may be selected at a time when an incoming call arrives. Pressing any of the line buttons assigns the incoming call to the selected line. Pressing a line button, i.e., left clicking, when the line is in use places the line on hold. Subsequent depressing the line button takes the call off hold.

A number of call function buttons **1408**, including the [RCL], [END], [SND], [DND], [MUT], [HLD], [CMP], [BLK], [PRI], [FWD], not all of which are shown in FIG. **14**, are used to control operation of calls. The [RCL] button is a momentary button used to recall the last number dialed. Pressing [RCL] recalls the last party called by displaying the party's name, alias, e-mail address and IP address, if known. Selecting a free line following depression of the [RCL] button followed by the [SND] button will cause the party last called to be dialed. The [END] button is a momentary button and terminates a call upon depression. The [SND] button is a momentary button and is used to both place and answer calls. Depressing the [SND] button when a call is being announced causes the call to be answered on a preselected line or a line indicated by the user. Depression of the [SND] button once a callee's information is entered into display **1402** causes the party to be called, if the required information is present, or otherwise causes an information server connection to be established and activated, as previously described.

The [DND] button is a toggle button and is used to activate the Do Not Disturb function of the WebPhone. When activated, the [DND] button causes all inbound calls to be routed to the answering machine.

The [MUT] button is a toggle button which, upon depression, causes disabling of the microphone associated with a user's WebPhone system. When the [MUT] button is enabled, the main LED **1402**F and the status line **1402**H change to indicate that the call muted. Depression of the [MUT] button is undetected by one or more callees.

The [HLD] button is a momentary button and is used to place a call on hold. When a user depresses the [HLD] button a party or parties to a conference call are placed on hold, e.g., the microphone and speaker of the system are effectively disabled. When a called is placed on hold, the main LED **1402**F and call status field **1402**H indicate the change. To take a call off hold, the user depresses the line button of the call being held.

The [CMP] button is a momentary button that causes the WebPhone user to camp on a party, i.e., perpetual redial. Camping on a party serves to insure that the user's call will go through when the party is available. After placing a call, if the callee responds with either a busy or on off-line status, the user may press the [CPM] button to camp on that party. To remove a camp from a party, the user presses the delete key from the computer keyboard.

The [BLK] button is a toggle button and enables or disables call blocking. Depression of the [BLK] button enables call blocking causing all inbound calls from parties who have call blocking designated in their information profile within the personal information directory to be either rejected or routed to the answer machine. Whether a call is to be rejected or routed to the answering machine is specified in a party's information profile record within the personal information directory, in a manner, as previously described.

The [PRI] button is a toggle button which enables or disables priority ringing. Depression of the button enables

priority ringing of all inbound calls from parties, i.e. generation of customized sound effects and/or graphic announcements when a call arrives. As with call blocking, priority ringing is specified within a party's information profile record in the user's personal information directory.

The [FWD] button is a toggle button which enables or disables call forwarding. Depression of the button enables call forwarding of selected inbound calls to the party specified in the appropriate information profile record in the personal information directory. The WebPhone will first search in the personal information directory for an information profile record which matches the inbound call. If a match occurs, and call forwarding is enabled, the inbound call will be forwarded to the party designated within the matched information profile record. If no party is designated, the call will be forwarded to a default forwarding party.

In addition to the call function buttons, a number of phone function buttons **1410** including a [CFG], [DIR], [MSG], [DAT], [LOG], [ ], and ? buttons enable users to further direct functions of a phone. Specifically, the ? button is a momentary button which invokes an interactive, multimedia tutorial and help system about the WebPhone. The [CFG] button is a momentary button, depression of which launches a configuration dialog which enables the user to change the operating parameters of the WebPhone. The [DIR] button is a momentary button, depression of which launches the phone directory dialog which enables a user to add, store, update, view, and delete parties and to obtain directory assistance from global server **1500**, as described previously. The [MSG] button is likewise a momentary button, depression of which launches the voicemail message dialog which enables a user to view, sort, playback, delete, save and restore voicemail messages, as well as to create, playback, delete, save, and restore custom outgoing messages and assign them to information profile records in the personal information directory.

The [DAT] button is a momentary button, depression of which launches a data file transfer dialog enabling a user to monitor and control the progress of a data file transferred over the communication link established with the WebPhone, such dialog further enables a user to retrieve and create E-mail.

The [LOG] button is a momentary button, depression of which launches a call activity log dialog which enables a user to use, sort, search for, print, and delete call related events. An "X" icon is provided to exit the WebPhone. If one or more calls are active when the X icon is selected, a dialog box will appear asking the user if he/she really wishes to exit and terminate active calls. Other icons are provided for minimizing or iconifying the WebPhone application.

In addition to the above-described display, the WebPhone GUI **1400** includes a number of audio control buttons and sliders (not shown in FIG. **14**). These graphic elements enable the user to control the recording the playback of voicemail and outgoing messages and operate similar to conventional audio tape deck controls. In the illustrative embodiment, and similar to that shown in FIG. **5**, a progress bar is illustrated which displays the extent of progress during playback and audio recording processes. Momentary buttons may be provided for rewinding the "virtual tape" to the beginning and for fast forwarding the tape to the end of a recording. Further, momentary buttons are provided for aborting, as well as stopping, playback of audio. A speaker card button, implemented as a toggle button, is provided to play back audio on the sound card's speaker. A special momentary button for audio playback is provided. When initially depressed, audio playing commences. The button then pops out and becomes a pause button. Subsequent depression pauses the audio. The button then pops out again to become a play button. A record button, in the form of a toggle button is provided to control recording of audio. When the button is depressed the user is in an audio record mode and can record voicemail or outgoing messages. To stop recording, the button is pressed again or the stop is button is pressed. A slider-type graphic potentiometer is provided to control speaker volume and enables the user to adjust output volume of the audio received during conversation and playback of voicemail and outgoing messages. The speaker control will attenuate the sound card speaker volume. A similar control is provided to control microphone volume and enables the user to adjust the input volume of audio recorded during conversation and recording of voicemail and outgoing messages. The microphone slider control attenuates the sound card's microphone volume.

WebPhone Application Object Implementation

As previously described, with reference to FIGS. **13**A–B, the WebPhone application comprises a set of object modules which work together in a concerted fashion to provide real-time, multitasking, network-based media transmission and reception. Specifically, the WebPhone GUI, user interface, event manager, and media engine utilize a number of objects to house and manipulate data associated with the operation of the WebPhone application. The GUI objects control the look and feel of the graphic user interface controls which comprise the WebPhone user interface. Some user interface objects maintain and manage many of the states of the WebPhone and control the behavior of the GUI controls, as illustrated in FIGS. **18**A–D.

FIG. **18**A illustrates the hierarchical relationship between objects within the WebPhone. The UIVirtualBase **1812** is a class from which UIVirtualControl object **1810** and UIVirtual object **1808** inherit their respective attributes and member functions. GUIControl object **1802** inherits its attributes and member functions from UIVirtualControl **1810**, as illustrated. UICollection object **1806** inherits its properties from the UIVirtual object class **1808**. The UIControl object inherits its attributes and member functions from both the UIVirtual control object class **1810** and the UIVirtual object class **1808**.

Referring to FIG. **18**B the UIControl object **1804** itself serves as a class from which the UIButton object **1828**, UISlider object **1826**, UIScroller object **1824**, UITab object **1822**, UIDisplay object **1818**, UIListBox object **1820**, UIComboBox **1814**, and UIEditBox **1816** are subclasses. As illustrated in FIG. **18**C, the UIPushButton **1842**, UIPlayRun object **1844** and UIToggle object **1846**, are subclasses of the UIButton object **1848**. As illustrated in FIG. **18**D, the UIPhone object **1838**, UICall object **1832**, UILine object **1834**, and UIPopUp object **1836** are derived from or inherit their attributes and member functions from the UICollection object class **1806**.

Each WebPhone control has two objects associated therewith, a windowing system specific GUIcontrol object **802** and a generic UI control object **1804**. When the GUIcontrol object's state is changed by the user, GUIcontrol **1802** verifies the change with UIcontrol **1804** to validate the change. UIcontrol **1804** is a child of the UIcollection **1806**. When UIcontrol's sibling, GUIcontrol **1802** requests UIcontrol **1804** to verify a change, and the change is accepted, GUIcontrol **1802** must verify the change with its parent object. The parent UIcollection **1806** may have its own parent, another UIcollection object, that it must verify the change with. The UIPhone object **1838** is a member of the

UI collection class. UIPhone has final approval over all changes in the state of the WebPhone. UIPhone **1838** further tells child objects when the event manager changes the phone state and further creates jobs for the event manager based on user actions.

The WebPhone drag and drop functionality utilizes the standard Windows® drag and drop interface and adds several unique object types to interact therewith. Specifically, each UIcontrol and GUIcontrol object has two new member functions added, e.g., set dragtype and acceptdrop types. The set dragtype call sets the type of drag that the control will perform if the mouse or other pointing device is moved out of the control window with the left mouse button down. The accept droptype defines the types of drags the control will accept.

Event Manager and Media Engine

The event manager is a state machine consisting of an array of pointers to functions and states which make up a state-event table. When an event occurs as caused by the mouse, keyboard, mic, speaker, or socket, it is up to the user interface to determine if the event requires the attention of the event manager. The event manager is not notified of events which effect only the graphic user interface, e.g., the user depresses the [DIR] button to open the phone directory dialog.

Referring to FIGS. **19**A–C, a conceptual block diagram illustrating the event manager and media engine objects utilized by the WebPhone is presented. Specifically, the following objects are utilized by both the user interface and the event manager to manager the state of calls and tasks that are to be performed:

line
job
party
task

As illustrated in FIG. **19**A, a Line object is represented by the pentagon shape with a number contained therein. The Line object has the attributes of state and duration and a *job pointer. Member functions for the Line object include createcall ( ) and removecall ( ). The Job object is illustrated with a rectangle having pointers extended therefrom as illustrated in FIG. **19**A. Attributes of the job object include, ID, type, state, and parties, and pointer attributes party, intask, outTask, nextjob, prevjob. The Job object has the member functions of AddParty, RemoveParty, CreateTask, and RemoveTask. The Party object, illustrated with a triangular symbol, includes the attributes of state, session, socket, and partyRec, and the member functions of LoadParty.

The Task object includes the attributes of command, source, destination, extent, fileHandle, fileType, fileLength, fileSize, mic, speaker, and flags, as wells as pointer attributes *job and *buf. The values assumable by the command attribute of the Task object may include initialize, close, start, stop, fill, and use, etc. The values assumable by the source and destination attributes of the task object may include microphone, speaker, socket, and file. FIG. **19**B illustrates the relationship between Line objects and Job objects and the pointers linking the two. FIG. **19** illustrates the relationship between Party objects, Job objects and Task objects and the pointers linking the Job objects to the parties and tasks.

Media Engine Implementation

FIGS. **20**A–D illustrate the process steps performed by the media engine of the WebPhone in accordance with the present invention. The coding of the process steps of the flowchart of FIGS. **20**A–D and to instructions suitable for use by the WebPhone will be understandable by those having ordinary skill in the programming arts. FIG. **20**A illustrates the process executed by the media engine when the CMD attribute of a Task object is defined as a AE_USEME command, as previously illustrated in FIG. **19**A. The Task objects are set up by the event manager. The media engine manages routing and resources. For example a microphone, file or socket may provide a source of data to media engine while a destination may comprise either a speaker file or socket. The media engine serves to perform compression/decompression as well as copying functions. For the purposes of describing flowcharts **20** A–D the media engine will referred to as media engine **2000**.

Referring to FIG. **20**A, media engine **2000** first determines the source of a data stream, as illustrated by decisional block **2002**. If the source is a microphone, media engine **2000** determines whether or not the current audio data from the microphone source is silence, as illustrated in decisional block **2004**. If the audio stream from the microphone is not silent the data will be accumulated into a microphone buffer, as illustrated by procedural block **2006**. Next, the media engine will determine whether or not the buffer is full, as illustrated by decisional **2008**. If the buffer is full, process flow will proceed to a determination of the destination via connector Q. If in decisional block **2004** the determination was made that the audio data from the microphone was silence, the media engine notes the length of the silence, as illustrated by procedural block **2010**. Next, the media engine determines whether or not the buffer is empty, as illustrated by decisional block **2012**. If the buffer is empty, process flow proceeds to a determination of the source, via connector R, as illustrated by decisional block **2030**.

Returning again to decisional **2014**, a determination of the destination of the audio data made after either a determination that the buffer is full, via connector Q, or that the source of the audio data is a socket, e.g., one of the branches of decisional block **2002**. If in decisional block **2014** a determination is made that the destination is a socket, media engine **2000** determines if a party is online, as illustrated by decisional block **2028**. If the party is online media engine **2000** will write to the socket associated with that party, as illustrated by procedural block **2026**. The process as illustrated by decisional **2028** and process block **2026** are repeated for every party associated with the Job object, i.e., conference calls include multiple parties. Following writing to the parties socket, process flow returns decisional block **2030** for a determination of the source, as illustrated. If in decisional block **2014** a determination was made that the speaker was the destination, media engine makes a further determination to whether or not the there is more than one party on the conversation, i.e., conference call, as illustrated by decisional block **2020**. If there is only one other party besides the user on the call, process flow proceeds to junction K where the audio data is written to the speaker, as illustrated by process block **2022**. If in decisional block **2020** a determination was made that multiple parties were associated with a call media engine **2000** mixes the audio data into a mixing buffer, as illustrated by process block **2016**. Next media engine **2000** determines whether or not the speaker is idle. If so, the audio data from the mixing buffer is written to the speaker as illustrated by procedural block **2022**. Otherwise, process flow proceeds to junction R. In decisional block **2030** media engine **2000** determines again what the source of an audio data stream is. If the source is determine to be a socket, media engine **2000** will place the empty buffer on the winSock queue, as illustrated by process block **2036**. If the source is determined to be a microphone, and the microphone is enabled, as determined in decisional

block **2032**, media engine **2000** will place the empty buffer on the mic sampling queue, as illustrated by process block **2034**. Otherwise, media engine **2000** will place the empty buffer in the free pool of buffer space, as illustrated by process **2038**. Either branch of decisional block **2030** will result in a return from the task execution process, as illustrated.

FIG. **20**B, illustrates the process flow performed by media engine **2000** upon receiving a task object from the event manager having the CMD attribute defined with a AE_START, i.e., the event manager instructs the media engine to start a copy operation from a source to a destination. First, media engine **2000** determines whether or not the source is a microphone or a file, as illustrated by decisional block **2040**. If the source is a file, process flow proceeds to block **2062** of FIG. **20**C via connector F, as described hereinafter. If the source is determined to be a microphone, media engine **2000** will determine whether or not the microphone is on, as illustrated by decisional **2044**. If the microphone is not on, an internal error notification will be generated, as illustrated by procedural block **2046**. If the microphone is on, media engine **2000** will enable microphone sampling, obtain space from the buffer pool, and perform an asynchronous read from the microphone, as illustrated by process blocks **2048**, **2050** and **2052**, respectively. If in decisional block **2040** media engine **2000** determined that the source was a socket, buffer space will be retrieved from the buffer pool, as illustrated by process block **2042**, and an asynchronous read from the socket will be performed, as illustrated by process block **2045**. Following the an asynchronous read from either a socket or a microphone, media engine **2000** will return the task to the event manager, as illustrated.

FIG. **20** illustrates the process flow performed by media engine **2000** upon receiving a Task object from the event manager in which the CMD attribute is defined with a AE_FILLME command value, i.e., an empty packet has been returned from either an MCI or WINSOCK asynchronous write operation upon completion. First, media engine **2000** determines whether the source is from a file or either a socket or speaker, as illustrated by decisional block **2054**. If the source is a file, media engine **2000** will read a portion of the file, as illustrated by process block **2062**. Next, media engine **2000** will make a determination as to whether the destination is either a socket or a speaker, as illustrated by decisional block **2068**. If the destination is a socket process flow will return to decisional block **2028** of FIG. **20**A via connector S, as illustrated. If the destination is a speaker, process flow will proceed to process block **2022** of FIG. **20**A via connector K as illustrated.

If a determination was made in decision **2056** that the destination is a socket, media engine **2000** will place the buffer associated with the task or message in the WINSOCK free pool of buffer space, as illustrated by process block **2058**. If the destination is determined to be a speaker, media engine **2000** next determines whether or not the buffer is empty, as illustrated by decision block **2060**. If the buffer is not empty, the data within the mixing buffer will be written to the speaker, as illustrated by message **2064**. If the buffer is empty, the buffer associated with the message, i.e., task, will be placed in the MCI message free pool, as illustrated by process block **2066**. Both branches decisional block **2056** result in a return from the task by media engine **2000**, as illustrated. In the above-described flow diagrams, a message may be a task implementation similar to the manner in which Microsoft Windows uses messages for task completion operations.

FIG. **20**D illustrates the process path taken by media engine **2000** when the CMD attribute of a Task object is defined as a AE_STOP value, i.e., the event manager instructs the media engine to stop the current operation on behalf of a specified task. The process begins with the determination of whether or not the source is a microphone or file, as illustrated by decisional block **2070**. If it is determined that the source is a file, process flow proceeds to block **280** where the source is set to none, i.e., no further data will retrieved or processed. If the process is determined to be a socket, media engine **2000** cancels any pending asynchronous reads from the socket, as illustrated by process block **2074**. If a determination is made that the source is a microphone, media engine **2000** will determine whether or not the microphone is on, as illustrated by decisional block **2072**. If the microphone is on, media engine **2000** cancels sampling of the audio signal from the microphone, as illustrated by process block **2076**, and, discards the pending data in the mix buffer, as illustrated by process block **2078**. Regardless of the determination of the source, all branches of the process flow terminate with the setting of the source to none or null, indicating a termination of the operation and a return by media **2000** from the task, as illustrated.

In an alternate embodiment, the various aspects of the invention may be implemented as a computer program product for use with a computer system. Such implementation may comprise a series of computer instructions either fixed on a tangible medium, such as a computer readable media, e.g. diskette **1142**, CD-ROM **1147**, ROM **1115**, or fixed disk **1152** of FIG. **11**, or transmittable to a computer system, via a modem or other interface device, such as communications adapter **1190** connected to the network **1195** over a medium **1191**. Medium **1191** can be either a tangible medium, including but not limited to optical or analog communications lines, or may be implemented with wireless techniques, including but not limited to microwave, infrared or other transmission techniques. The series of computer instructions embodies all or part of the functionality previously described herein with respect to the invention. Those skilled in the art will appreciate that such computer instructions can be written in a number of programming languages for use with many computer architectures or operating systems. Further, such instructions may be stored using any memory technology, present or future, including, but not limited to, semiconductor, magnetic, optical or other memory devices, or transmitted using any communications technology, present or future, including but not limited to optical, infrared, microwave, or other transmission technologies. It is contemplated that such a computer program product may be distributed as a removable media with accompanying printed or electronic documentation, e.g., shrink wrapped software, preloaded with a computer system, e.g., on system ROM or fixed disk, or distributed from a server or electronic bulletin board over a network, e.g., the Internet or World Wide Web.

Although various exemplary embodiments of the invention have been disclosed, it will be apparent to those skill in the art that various changes and modifications can be made which will achieve some of the advantages of the invention without departing from the spirit and scope of the invention. These and other obvious modifications are intended to be covered by the appended claims.

TABLE 1

Client Table

Field	Data Type	Comments
id	ulong	Unique ID Sequence
activated	char	0 = NO, 1 = YES
activationDate	ulong	Secs since 00:00 UTC Jan 1, 1970
version capability	ushort	Version of the Webphone
version protocol	ushort	
version vendor	ushort	
paid	char	0 = NO, 1 = YES
prePaidCode	varchar (16)	
firstName	varchar (10)	
lastName	varchar (25)	
alias	varchar (20)	
emailAddr	varchar (90)	
IPAddr	varchar (80)	0.0.0.0 if not known
street	varchar (50)	
apt	varchar (5)	
city	varchar (20)	
state	varchar (20)	
country	varchar (20)	
postalCode	varchar (20)	
phone	varchar (25)	
fax	varchar (25)	
feature bits	ulong	WebPhone Feature Definitions
company	varchar (25)	Company Name
addrChanges	char	No. of address changes
addrChangeDate	ulong	Secs since 00:00 UTC
publish	char	0 = NO, 1 = YES
accessDate	ulong	Secs since 00:00 UTC
accessCount	ulong	# of log ons
callCount	ulong	# of outbound calls
social security number	ulong	optional
age	ushort	optional
occupation code	ushort	optional
interest codes	ushort	optional
household income range	ushort	optional

TABLE 2

Online Table

Field	Data Type	Comments
emailAddr	varchar (90)	
IPAddr	varchar (80)	
flags	char	
onlineDate	ulong	Secs since 00:00 UTC

TABLE 3

WebBoard Table

Field	Data Type	Comments
id	ulong	Unique ID Sequence
image	varchar (255)	Filename of image file
imageType	char	GIF = 0, JPG = 1, RLE = 3
audio	varchar (255)	Filename of TSP encoded.WAV file
audioType	char	GSM = 0, TRUESPEECH = 1
hits	ulong	Number of accrued hits
hitsprofile	varchar (8)	Filename of Demographics
version	ulong	version of WebBoard
URL	varchar (255)	home page url

TABLE 4

Weboard Config Table

Field	Data Type	Comments
count	ulong	Number of WebBoards

TABLE 5

Source Table

Field	Data Type	Comments
id	ulong	Unique ID Seqence
weboardID	ulong	Link to WebBoard record
name	varchar (50)	Company's name
url	varchar (80	URL to Home Page
street	varchar (50)	
apt	varchar (5)	
city	varchar (20)	
state	varchar (20)	
country	varchar (20)	
postalCode	varchar (20)	
phone	varchar (25)	
fax	varchar (25)	
contact	varchar (35)	Name of contact

TABLE 6

WebPhone Protocol (WPP) Packet Definitions

Packet	Packet Type	Direction	Data
Invalid	WPP_INVALID	← →	WPP_INVALID
Online Req	WPP_ONLINEREQ	→	WPP_ONLINEREQ, sid, version, emailAddr, IPAddr, onlineState, feature bits
OnlineACK	WPP ONLINEACK	←	WPP_ONLINEACK, sid onlineStatus, feature bits
Offline	WPP_OFFLINE	← →	WPP_OFFLINE, sid
Hello	WPP_HELLO	← →	WPP_HELLO, sid, version
Connect Req	WPP_CONNECTREQ	→	WPP_CONNECTREQ, sid, version, callType, partyEmailAddr, emailAddr,

TABLE 6-continued

WebPhone Protocol (WPP) Packet Definitions

Packet	Packet Type	Direction	Data
			IPAddr, connectState
Connect ACK	WPP_CONNECTACK	← →	WPP_CONNECTACK, sid, connectStatus, partyIPaddr
Call	WPP_CALL	← →	WPP_CALLACK, sid, version, emailAddr, IpAddr, userInfo
CallACK	WPP_CALLACK	← →	WPP_CALLACK, sid, version, emailAddr, IpAddr, userInfo
CnfCall	WPP_CNFCALL	← →	WPP_CNFCALL, sid, version, emailAddr, IpAddr, userInfo
CnfCallACK	WPP_CNFCALLACK	← →	WPP_CNFCALLACK, sid, version
Answer	WPP_ANSWER	← →	WPP_ANSWER, sid
Busy	WPP_BUSY	← →	WPP_BUSY, sid
AnsMachine	WPP_ANSMACH	← →	WPP_ANSMACH, sid, state
End	WPP_END	← →	WPP_END, sid
Hold	WPP_HOLD	← →	WPP_HOLD, SID, (ON/OFF)
Reject	SPP_REJECT	← →	WPP_REJECT, sid
Camp	WPP_CAMP	← →	WPP_CAMP, sid
CampACK	WPP_CAMPACK	← →	WPP_CAMPACK, sid
Audio	WPP_Audio	← →	WPP_AUDIO, sid, audioType, silence, length, audioData
Pulse	WPP_PULSE	→	WPP_PULSE, sid
Adjpulse	WPP_PULSE	←	WPP_ADJPULSE, sid, adjPulse
Vmail	WPP_VMAIL	← →	WPP_VMAIL, sid, audioType, silence, length, audioData
VmailEnd	WPP_VMAILEND	← →	WPP_VMAILEND, sid
OgmEnd	WPP_OGMEND	← →	WPP_OGMEND, sid
CnfAdd	WPP_CNFADD	← →	WPP_CNFADD, sid, partyEmailAddr, partyIPaddr, partInfo
CnfDrop	WPP_CNFDROP	← →	WPP_FILEXMTREQ, sid, file Type, fileName, fileSize

TABLE 7

WebPhone Protocol (WPP) Packet Definitions

Packet	Packet Type	Direction	Data
FileXmtAck	WPP_FILEXMTACK	← →	WPP_FILEXMTACK, sid
File	WPP_FILE	← →	WPP_FILE, sid, length, fileData
FileXmtEnd	WPP_FILEXMTEND	← →	WPP_FILEXMTEND, sid
FileXmtAbort	WPP_FILEXMTABORT	← →	WPP_FILEXMTABORT, sid
InforReq	WPP_INFOREQ	→	WPP_INFOREQ, sid, query
InfoACK	WPP_KNFOACK	←	WPP_INFOACK, sid, nparties
Info	WPP_INFO	←	WPP_INFO, sid, partyInfo
InfoAbort	WPP_INFORABORT	→	WPP_INFOABORT, sid
UserInfoReq	WPP_USRINFOREQ	←	WPP_USRINFOREQ, sid
UserInfo	WPP_USRINFO	→	WPP_USRINFO, sid, version, userInfo
WBImageStart	WPP_WBIMAGESTART	←	WPP_WBIMAGESTART, sid, fileSize, imageType, url
WBImage	WPP_WBIMAGE	←	WPP_WBIMAGE, sid, length, imageData
WBImageEnd	WPP_WBIMAGEEND	←	WPP_WBIMAGEEND, sid
WBAudioStart	WPP_WBAUDIOSTART	←	WPP_WBAUDIOSTART, sid, fileSize, audioType
WBAudio	WPP_WBAUDIO	←	WPP_WBAUDIO, sid, length, audioData
WBAudioEnd	WPP_WBAUDI(OEND	←	WPP_WBAUDIOEND, sid
Registration	WPP_REG	←	WPP_REG, sid, feature bits, EEMAILAddr, customer id
Audio Start	WPP_AUDIO START	← →	WPP_AUDIO START, sid
Audio End	WPP_AUDIO END	← →	WPP_AUDIO END, sid
Caller OK	WPP_CALLEROK	→	WPP_CALLEROK, sid, version, emailAddr, feature bits
Caller ACK	WPP_CALLERACK	←	WPP_CALLERACK, sid, callerStatus, feature bits
Key Pad	WPP_KEYPAD	←	WPP_KEYPAD, size (ON/OFF)
Key	WPP_KEY	→	WPP_KEY, sid, ascii character
WBLIST	WPP_WBLIST	←	WPP_WBLIST, sid, list of WB IDs
WBLIST REQ	WPP_WBLISTREQ	→	WPP_BBLISTREQ, sid

TABLE 7-continued

WebPhone Protocol (WPP) Packet Definitions

Packet	Packet Type	Direction	Data
WB REQ	WPP_WEBBOARDREQ	→	WPP_WEBBOARDREQ, sid, WBid, Client id
WB HIT	WPP_WEBBOARDHIT	→	WPP_WWBOARDHIT, sid, WB id, Client id
ANS FULL	WPP_ANS FULL	→	WPP_ANS FULL, sid

TABLE 8

WebPhone Protocol (WPP) Packet Data Definitions

Element	Data Type	Comment
WPP_*	unsigned char	WPP message identifier
sid	unsigned long	session id unique per call
version	unsigned(3)	version of the webphone (capability, protocol, vendor)
emailAddr	varchar(90)	email address of caller
IPAddr	varchar(80)	IP Address
onlineState	unsigned char	bit 0 (ACTIVE/INACTIVE) bit 1 (Merchant Phone) bit 2 (Connection Server) bit 3 (webboard disabled) bit 4 Not Used bit 5 Not Used bit 6 Not Used bit 7 Not Used
call Type	unsigned char	call type 0: EMAIL/1:IPCALL
party EmailAddr	varchar(90)	email address of person to call
connectStatus	unsigned char	0: NO WEBPHONE 1: ONLINE 2: OFFLINE 3: RECONNECT 4: PERM_RECONNECT
partyIPAddr	varchar(80)	IP Address of person to call
userInfo	varchar(120)	firstName, LastName, alias, emailAddr, street, apt, city, state, country, postalCode, phone, fax, company
audioType	unsigned char	audio compress type 0: GSM 1: TRUESPEECH

TABLE 9

WebPhone Protocol (WPP) Packet Data Definitions

Element	Data Type	Comment
length	unsigned short	length of audio or data in bytes
audioData	512 Bytes	compressed audio data
feature bits	unsigned long	WebPhone feature definition
fileType	unsigned char	file type 0: DATA 1: EMAIL 2: TEXT 3: BINARY
fileName	varchar(13)	name of file to be transmitted.
fileSize	unsigned long	size of file to be transmitted in bytes
fileData	variable	file data
query	varchar(120)	firstName, lastName, company, city, state, country
nparties	unsigned long	number of parties or query records being sent
size	unsigned long	size of file (IMAGE or AUDIO) to be sent
imageType	unsigned char	image type 0: GIF 1: JPG
imageData	512 Bytes	image data

TABLE 9-continued

WebPhone Protocol (WPP) Packet Data Definitions

Element	Data Type	Comment
eemailAddr	varchar(90)	encrypted email Address
onlineStatus	unsigned char	0 OK −1 Error
callerStatus	unsigned char	0 is unpaid 1 if paid
onlineState	unsigned char	bit 0 webboard disabled bit 1 Not Used bit 2 Not Used bit 3 Not Used bit 4 Not Used bit 5 Not Used bit 6 Not Used bit 7 Not Used
WBid	unsigned long	link to WebBoard record
adjpulse	unsigned long	timer offset in secs

TABLE 10

Feature Definition

feature bit 0	0 = 1 line	1 = 4 lines
bit 1	0 = Limited Call Time	1 = Unrestricted Call Time
bit 2	0 = Limited VMail OGM	1 = Unlimited Vmail OGM
bit 3	0 = Limited Directory Entries	1 = Unlimited Dir Entries
bit 4	0 = Webboard Not Disabled	1 = Allowed to Disable
bit 5	0 = Conferencing (audio) Disabled	1 = Conferencing Enabled
bit 6	0 = Conferencing (video) Disabled	1 = Conferencing Enabled
bit 7	0 = Whiteboard Disabled	1 = Whiteboard Enabled
bit 8	0 = Offline voicemail Disabled	1 = Offline voicemail Enabled
bit 9–27	Reserved	
bit 28–30	Type of Phone 0 - Normal webphone 1 - Agent 2 - Business webphone 3 - Gateway 4 - ACD 5 - 7 reserved	
bit 31	1 = Disable all WebPhone features	

TABLE 11

Offset	Name	Size	Description
	Reserved		Reserved
+1	SessionID	4	Unique value for duration of this connection
+5	Version	6	WebPhone version and distributor stamp

TABLE 11-continued

Offset	Name	Size	Description
+11	Codec	1	Audio compression algorithm selected
+12	FirstName	10	Given name, middle initial
+22	LastName	25	Surname
+47	Alias	20	Nickname
+67	EmailAddr	90	Caller's electronic mail address
+157	IpAddr	80	Caller's WebPhone's Internet address
+237	Street	50	Street address of user
+287	Apt	20	Apartment or suite number
+307	City	20	City name
+327	State	20	State or province
+347	Country	20	Country name
+367	ZipCode	20	Zip or postal code
+387	Phone	25	Telephone number
+412	Fax	25	Facsimile telepone number
+437	Company	25	Employer or organization name
+487	File Name	25	Name of file
+512	Action Code	25	Action descriptor
+537	File Type	10	File type descriptor
+547	Status	25	Status of WebPhone utility

We claim:

1. A computer program product for use with a computer system having a display and an audio transducer, the computer system capable of executing a first process and connecting to other processes and a server process over a computer network, the computer program product comprising a computer usable medium having computer readable code means embodied in the medium comprising:

a. program code for generating a user-interface enabling control a first process executing on the computer system;

b. program code for determining the currently assigned network protocol address of the first process upon connection to the computer network;

c. program code responsive to the currently assigned network protocol address of the first process, for establishing a communication connection with the server process and for forwarding the assigned network protocol address of the first process and a unique identifier of the first process to the server process upon establishing a communication connection with the server process; and

d. program code means, responsive to user input commands, for establishing a point-to-point communications with another process over the computer network.

2. The computer program product of claim **1** wherein the program code for establishing a point-to-point communication link further comprises:

d.1 program code, responsive to the network protocol address of a second process, for establishing a point-to-point communication link between the first process and the second process over the computer network.

3. The computer program product of claim **2** wherein the program code for establishing a point-to-point communication link further comprise:

d.2 program code for transmitting, from the first process to the server process, a query as to whether the second process is connected to the computer network; and

d.3 program code means for receiving a network protocol address of the second process from the server process, when the second process is connected to the computer network.

4. The computer program product of claim **2** wherein the program code for establishing a point-to-point communication link further comprises:

d.2 program code means for transmitting an E-mail message containing a network protocol address from the first process to the server process over the computer network;

d.3 program code means for receiving a second network protocol address from the second process over the computer network.

5. In a computer system having a display and an audio transducer, the computer system capable of executing a first process and communicating with other processes and a server process over a computer network, a method for establishing point-to-point communications with other processes comprising:

A. determining the currently assigned network protocol address of the first process upon connection to the computer network;

B. establishing a communication connection with the server process once the assigned network protocol of the first process is known;

C. forwarding the assigned network protocol address of the first process to the server process upon establishing a communication connection with the server process; and

D. establishing a point-to-point communication with another process over the computer network.

6. The method of claim **5** wherein the program step D comprises:

D.1 transmitting, from the first process to the server process, a query as to whether a second process is connected to the computer network; and

D.2 receiving a network protocol address of the second process from the server process, when the second process is connected to the computer network.

7. The method of claim **5** wherein the program step D comprises:

D.1 transmitting an E-mail message containing a network protocol address from the first process to the server process over the computer network;

D.2 receiving a second network protocol address from a second process over the computer network.

8. In a computer system having a display and capable of executing a process, a method for establishing a point-to-point communication from a caller process to a callee process over a computer network, the caller process capable of generating a user interface and being operatively connected to the callee process and a server process over the computer network, the method comprising the steps of:

A. generating a user-interface element representing a first communication line;

B. generating a user interface element representing a first callee process;

C. guerving the server process to determine if the first callee process is accessible; and

D. establishing a point-to-point communication link from the caller process to the first callee process, in response to a user associating the element representing the first callee process with the element representing the first communication line.

9. The method of claim **8** wherein step C further comprises the steps of:

C.1 querying the server process as to the on-line status of the first callee process; and

C.2 receiving a network protocol address of the first callee process over the computer network from the server process.

10. The method of claim **8** further comprising the step of:

E. generating a user-interface element representing a second communication line.

11. The method of claim **8** further comprising the step of:

F. terminating the point-to-point communication from the caller process to the first callee process, in response to the user disassociating the element representing the first callee process from the element representing the first communication line; and

G. establishing a different point-to-point communication from the caller process to the first callee process, in response to the user associating the element representing the first callee process with the element representing the second communication line.

12. The method of claim **8** further comprising the steps of:

E. generating a user interface element representing a second callee process; and

F. establishing a conference point-to-point communication between the caller process and the first and second callee processes, in response to the user associating the element representing the second callee process with the element representing the first communication line.

13. The method of claim **8** further comprising the step of:

G. removing the second callee process from the conference point-to-point communication in response to the user disassociating the element representing the second callee process from the element representing the first communication line.

14. The method of claim **8** further comprising the steps of:

E. generating a user interface element representing a communication line having a temporarily disabled status; and

F. temporarily disabling the point-to-point communication between the caller process and the first callee process, in response to the user associating the element representing the first callee process with the element representing the communication line having a temporarily disabled status.

15. The method of claim **14** wherein the element generated in step E represents a communication line on hold status.

16. The method of claim **15** wherein the element generated in step E represents a communication line on mute status.

17. The method of claim **8** wherein the display further comprises a visual display.

18. The method of claim **17** wherein the user interface is a graphic user interface and the user-interface elements generated in steps A and B are graphic elements.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO :6,009,469

DATED :December 28, 1999

INVENTOR(S) :Shane D. Mattaway, Glenn W. Hutton and Craig B. Strickland

It is certified that errors appear in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE CLAIMS:

In claim 1, column 41, line 23, after "having a display", please delete "and an audio transducer";

In claim 1, column 41, line 43, after "program code", please delete "means";

In claim 3, column 41, line 60, after "program code", please delete "means";

In claim 4, column 42, line 1, after "program code", please delete "means";

In claim 4, column 42, line 5, after "program code", please delete "means";

In claim 5, column 42, lines 8 and 9, after "having a display", please delete "and an audio transducer";

Signed and Sealed this

Eighth Day of May, 2001

Attest:

Nicholas P. Godici

NICHOLAS P. GODICI

Attesting Officer

Acting Director of the United States Patent and Trademark Office